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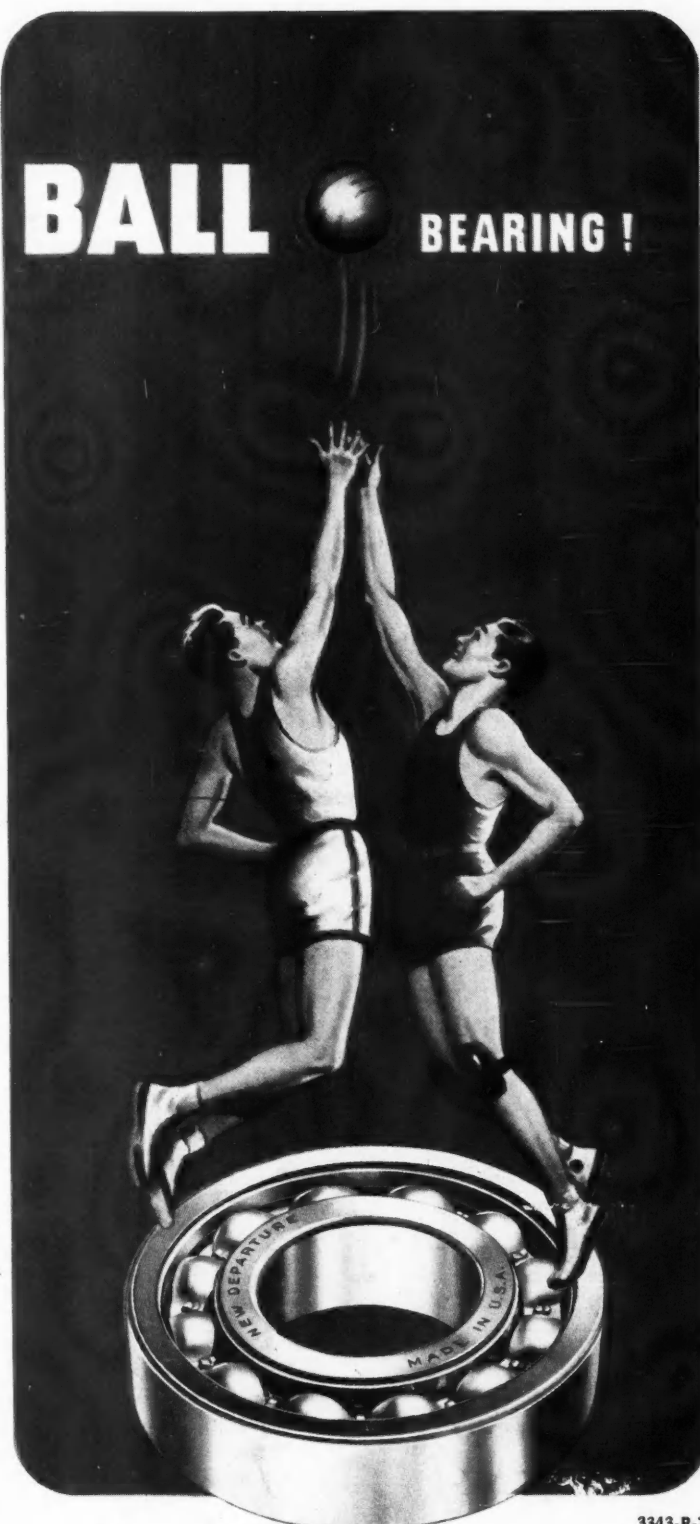
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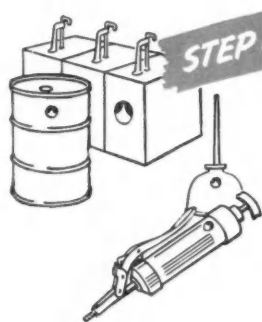
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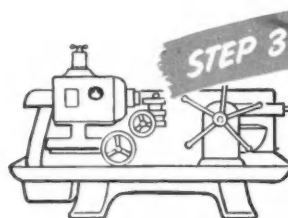


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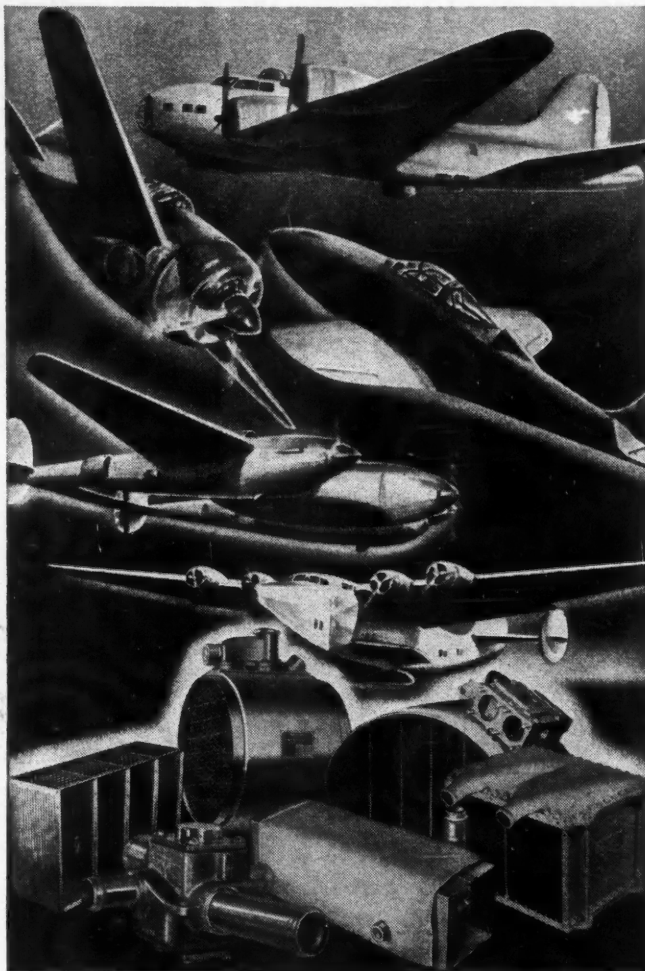
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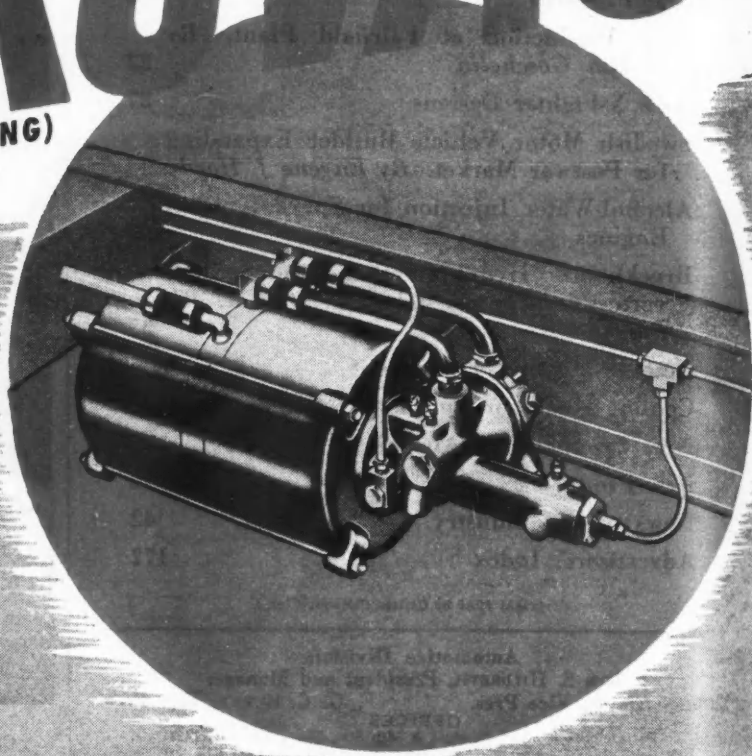
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The Price of Freedom

By H. W. Prentis, Jr.

AT THE stage between apathy and dependency, men always turn in fear to economic and political panaceas. New conditions, it is claimed, require new remedies. Usually so-called new remedies are not new at all. Compulsory planned economy, for example, was tried by the Chinese some three millenniums ago, and by the Romans in the early centuries of the Christian era. It was applied in Germany, Italy and Russia long before the present war broke out. Yet it is being vigorously advocated today as a solution of our economic problems in the United States.

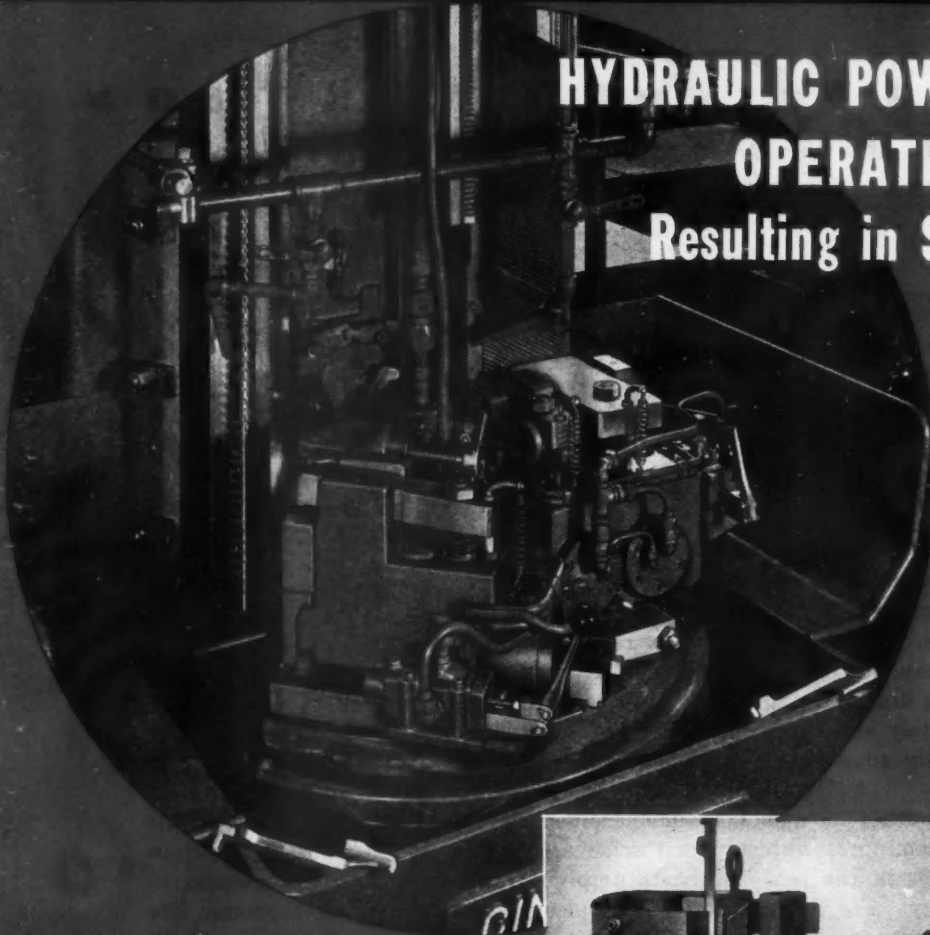
We desire neither a "monopoly business-dominated State" nor a "democratic State which dominates industry and science." We want no State domination whatever except in the sense of State umpiring and regulation of business to insure fair play. For State control—compulsory planning of our economic life by the State—means the ultimate destruction of our political freedom and all our hard-won civil and religious liberties. Many humanitarian thinkers ignore that point completely; yet the lessons of history all point in exactly that direction.

Under compulsory national economic planning in Germany before the war, was there freedom of the press? Was there freedom of suffrage in Italy? Did the farmer preserve his freedom in Russia? What happens to labor unions under planned economy? Is academic freedom permitted? How about freedom of worship? Well, then, can we not apply compulsory planning to a part of our economy and leave the rest to private business? Stalin says no, and so does Douglas Miller in his famous book about Hitler. That is the record. "Power over a man's support is power over his will," the Federalist Papers sagely observed. Yet I venture to predict that if we ever do lose our freedom in America it will be because of public ignorance of the perils involved in outright government planning and control of our economic life. All of which again demonstrates that the price of freedom is a deep understanding of the basic principles of self-government and recognition of the fact that "eternal vigilance is the price of liberty."

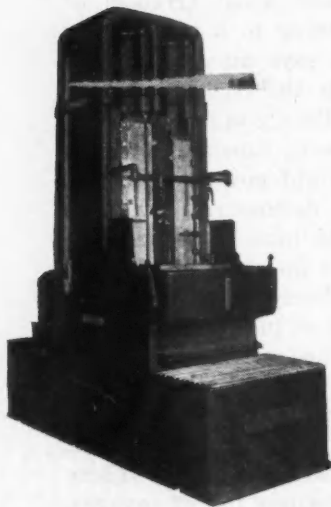
Pericles observed 2400 years ago that "The secret of liberty is courage"; not food, not comfort, not money, but just plain old-fashioned fortitude of body, mind and soul. In thinking about the Four Freedoms that we hear so much of these days, I have often wondered what the reaction of the Pilgrim Fathers would have been the day they landed on the rocky, barren coast at Plymouth if Governor Carver had said: Those of you who seek primarily freedom from want, come ashore. Not a man would have stirred. Again suppose he had said: Those of you who seek primarily freedom from fear in this wilderness full of savages, come ashore. Not a man would have left the ship. But, thank God, impending privation and fear did not daunt those sturdy pioneers. They had known at first-hand what political, intellectual and spiritual tyranny meant, and they were will-

(Turn to page 78, please)

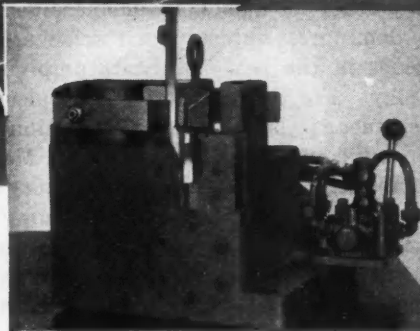
HYDRAULIC POWER FROM MACHINE OPERATES FIXTURES Resulting in Several Advantages



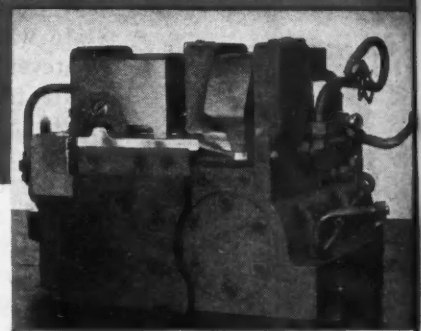
CINCINNATI No. 5-54 Duplex Vertical Hydro-Broach Machine. Equipped for two broaching operations on operating rod handle: right side, finger bar tip, and spot on tube section (right-hand ram) and 9/16" radius and form (left-hand ram).



CINCINNATI No. 5-42 Duplex Vertical Hydro-Broach Machine. Brief description of these productive and dependable machines may be found in Sweet's catalog file. Complete data may be obtained by writing for specification catalog, M-894-2.



Left-hand fixture and drawing of the part, showing surfaces broached.



Right-hand fixture and drawing of the part, showing surfaces broached.

Hydraulically powered machines like the CINCINNATI Hydro-Broach have a potential source of power which may be tapped for external work in conjunction with operation of the machine. Taking advantage of this characteristic, CINCINNATI Engineers developed the hydraulic fixtures shown on the No. 5-54 Duplex Hydro-Broach (above), for two broaching operations on rifle parts.

This type of equipment, the very latest for modern production methods, offers these important advantages: (1) *Easy to clamp and unclamp*; hydraulic power does the work. (2) *Safer for the operator*; provision for interrupted clamping action. (3) *Safer for the machine and inserts*; operating cycle cannot start until part is fully and properly clamped. (4) *Power is available from the machine*. (5) *Minimum wear*.

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TOOL ROOM AND MANUFACTURING MILLING MACHINES... SURFACE BROACHING MACHINES... CUTTER SHARPENING MACHINES

Why Manpower Limits the Automotive Industry's Output

By George Romney

Managing Director
Automotive Council for War Production

MANPOWER has been the major limiting factor on war output since early 1943. Since that period there have been many investigations of different aspects of the problem, but they have been of little or no value.

Collective bargaining for workers is an established process in this industry. The real issues affecting war production in automotive plants arise largely from the effort being made by union representatives to usurp the functions, responsibility, and authority of management.

Before the war few strikes and work stoppages involved cases of discipline of worker, job or plant productivity. Today these are the principle causes of strikes and work stoppages in the automotive industry. On top of that, strikes and stoppages are five times as numerous as in prewar years.

The union policy has been—and still is—to prosecute any grievance, manufactured or otherwise. Government policy, and for the most part Government agencies, support the unions with the result that some workers and union representatives have developed the attitude, "Labor can do no wrong." Government agencies, as well as management, have experienced the caustic, vituperative criticism and smear by labor representatives when they disagree with the opinions and desires of those representatives.

The standing of management with workers in the automotive industry and the general public had been so weakened by these smear campaigns of union representatives that immediately following Pearl Harbor an effort was made on the part of the union leaders

to obtain joint control with management of all production in the entire automotive industry. Even though the Office of Production Management created a joint management-labor committee to advise the Government on production programs for the automotive industry, union representatives were not satisfied with this advisory capacity. They demanded instead that the committee be given authority to control production in the industry. When this demand was rejected, the committee became inactive.

Union representatives discontinued open charges of "speed up," but continued their unpublicized efforts to muscle in on management's responsibility and authority. As production worker inefficiencies resulting largely from the union's early "speed up" charges became apparent, union representatives resumed their public smear campaigns to undermine confidence in management. They now publicly charged management with indifference toward such inefficiencies and developed new and misleading catch words, such as "labor hoarding," for smearing management.

It is not our view that this effort to take over management responsibilities is the sole cause of manpower problems, nor do we believe that restoration of power to discipline is a panacea for the problem. We are conscious, however, that if some existing conditions could be remedied, the industry could have produced even a greater volume of war goods or an equivalent amount with less manpower than we had to use in order to get the job done.

In keeping with its determination to do its utmost in expediting war production, the automotive industry began to study all aspects of the manpower situation early in 1943. At that time, a survey was made to determine the viewpoint of workers in a representative group of plants. The survey established these facts:

1. Most workers wanted to do more work;
2. Most workers wanted better discipline in the plants;
3. Workers were poorly informed on wartime problems which affect their individual jobs.

(Turn to page 74, please)

This article is excerpted from a report prepared by Mr. Romney expressing the views of the automobile industry on utilization of manpower and presented to the Senate War Investigating Committee, commonly known as the Mead Committee.

Elastic



Fig. 1-a—Distributor cap nipples molded from Vinylite elastomeric plastic.



Fig. 1-b—Results of a test on three nipples exposed to concentrated ozone for six hours, the plastic nipple (left) coming through perfectly. The natural rubber and synthetic rubber nipples are at the right and center, respectively.

TO THE sorrow of designers, these are days of material shortages. A tiny door bumper, a seal the size of an aspirin tablet, or an insulating cap may be as difficult to obtain as a vital drive gear. Changes of material require much more effort than the simple substitution of names, and so many changes have been required recently that it often seems as though there are no permanent specifications. There is an increasing tendency to regard as temporary fill-ins many materials which will be permanent, valuable additions to the designer's resources.

This situation is clearly illustrated by difficulties in the field of resilient molded parts. Since the war began, rubber and synthetic rubber have been substituted for each other in kaleidoscopic succession. But, in the midst of these changes an entirely different type of material has appeared on the scene—Vinylite elastomeric plastics. The Bay Manufacturing Division has used these resilient plastics on a variety of tough jobs where plastics had never been used. Their performance was such that they can be expected to become the standard choice for hundreds of other products. Today, the supply of Vinylite plastics is definitely limited, since they were placed on allocation long before Pearl Harbor and are strictly rationed.

However, their unique properties are so essential to many industrial molded goods that certain grades have been made available for this production.

The available grades are based on vinyl chloride-acetate, a chemical combination yielding one of the most versatile plastic groups. It can be produced in rigid or elastomeric form, as

sheets, sheeting, film, monofilaments, extrusion compounds, surface coating compounds, and injection- and compression-molding compounds.

Table I summarizes the properties of the molding compounds. Though the largest portion of Vinylite plastics is being used for vital insulation of wire and cable, these molding compounds have been tested thor-

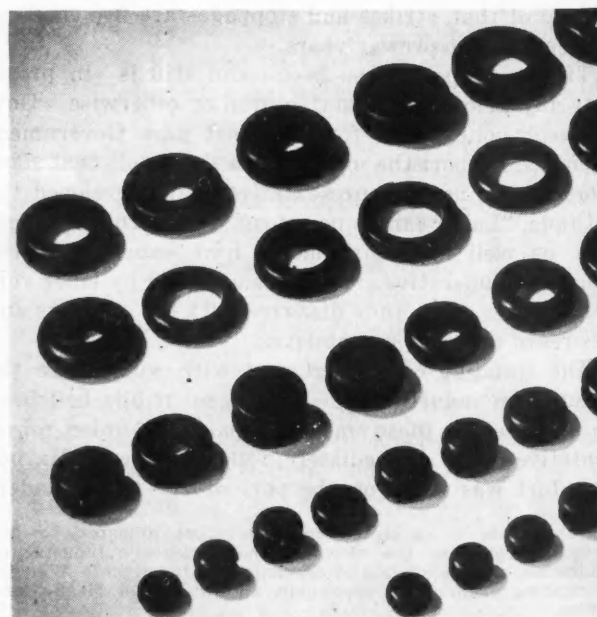


Fig. 2—Elastomeric plastic grommets.

Plastics—Today and Tomorrow

oughly, and our table does not record their excellent resistance to age and the erosive-corrosive action of chemicals and oils—properties of prime importance.

An outstanding advantage of these plastic materials is the speed with which they can be fabricated. More than 100 small pieces can be injection molded per minute. Large pieces decrease the production rate, but all operating cycles are short and speed is the rule.

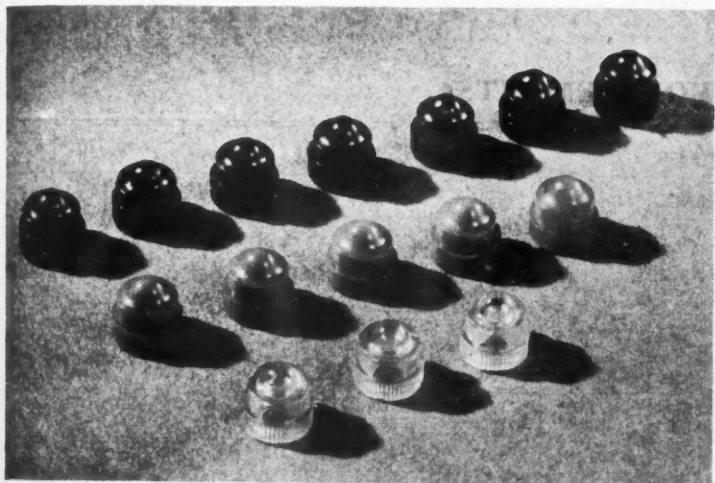


Fig. 3—Valve caps are now molded in a choice of colors.

Materials come from the producers, ready to use, without compounding or special treatment. As Vinylite molding compounds are thermoplastic, products are practically complete when molded. Once the gates and sprues are trimmed, they're ready for shipment. Further, there is no waste, as gates, sprues, and overflow can be re-fed to the hopper. All of these factors tend to reduce the cost of operation. Even today, before the advantages of full-scale production have been realized, many articles molded in vinyl plastics cost less than did their rubber counterparts before the war program.

Finally, elastomeric plastics can be produced in a widespread range of brilliant, permanent colors. This permits the color matching of a plastic part to its metal mate and vastly improves the appearance of such products as bumpers, grommets, seals, and connectors. At the present time, black is used almost exclusively, but a few high-gloss colored items and some transparent articles are being produced.

Among products improved by elastomeric plastic application are nipples for automotive distributor caps (Fig. 1-a). These nipples act as insulators where the electrical wiring ties into the distributor termi-

nals. Formerly, for civilian automobiles, they were usually made from compression-molded rubber compounds which required periodic replacement. Electric current discharged through atmosphere creates ozone, and distributor cap nipples receive the full impact of this destructive force.

At the start of war, the trend swung from rubber to compression-molded, rigid plastic materials. But these nipples were subject to dimensional distortion, and resultant apertures permitted accumulation of oil and dirt, with electrical discharge and grounding of wires soon following. So a search for a more satisfactory material was started. Among those investigated were synthetic rubber and Vinylite elastomeric compounds, both of which would grip the head firmly and so prevent the passage of dirt and moisture.

The real test of a distributor cap nipple's suitability—besides elasticity and insulation—is its resistance to ozone. Fig. 1-b shows the result of a test in which nipples made of different materials were subjected to highly concentrated ozone for 6 hours. The test was run at room temperature, and the nipples kept under tension as in actual service. Obviously, the natural rubber nipple (at right) is completely useless. The synthetic rubber nipple (center) is cracked—its efficiency as an insulator seriously affected. The nipple made of elastomeric plastic (left) is still unimpaired. Such tests, run by the automotive manufacturers themselves, indicate that the elastomeric plastic nipple will soon be much more widely specified as standard.

Another example of standard parts produced in vinyl plastics consists of the many grommets used in machinery generally. Fig. 2 shows a few stock sizes but is only an indication of the varieties that can be produced. The outer diameter,

the inner diameter, and the thickness can be varied by sixteenths of an inch to meet practically any requirement. Here again Vinylite elastomeric plastics have taken over a job performed by natural rubber, this time a job where a high degree of resistance to abrasion, fatigue, aging, water, chemicals, and oil is a prerequisite to serviceability and long life.

Today, tire valve caps of elastomeric plastic are replacing the metal caps which were so often conspicuous by their absence. A successful valve cap must do two things: first, hold air without leakage; second, cling to the valve stem despite dirt, water, oil, and wear. Vinyl chloride-acetate caps started as an experiment

By J. P. Kelso

Bay Manufacturing Div.,
Electric Auto-Lite Co.

TABLE I—Types and Grades of Vinylite Elastomeric Plastics

Note: The hardness values and low-temperature classifications in this table are included in these specifications for purposes of classification only and are not specific requirements to be met.

Type	Grade	Durometer Hardness ^a	Low-Temperature Classification ^b
I. Unfilled (plasticized with dioctyl phthalate or equivalent)	1	90±10	N
	2	90±10	N
	4	80±10	N
	5	70±10	F
	6	60±10	F
II. Cold resistant	7	70±10	F
	8	70±10	FF
III. Filled (plasticized with dioctyl phthalate or equivalent and containing an inert filler)	9	70±10	
	10	60±10	

^a Tentative Method of Test for Identification of Rubber by Means of the Durometer (ASTM Designation: D 676), 1944 Book of ASTM Standards, Part III.

^b A low-temperature classification of FF indicates that the material does not fail at -57 C. (-70 F), a classification of F indicates that the material does not fail at -40 C (-40 F), and a classification of N indicates that the material fails at -40 C (-40 F) when tested in accordance with the Tentative Method of Test for Low-Temperature Brittleness of Rubber and Rubber-like Materials (ASTM Designation: D 736), 1944 Book of ASTM Standards, Part III.

DETAIL REQUIREMENTS^a

Types and Grades	Type I					Type II		Type III	
	Grade 1	Grade 2	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10
Specific gravity, (77/77 F) (max. min.)	1.29 1.24	1.26 1.22	1.24 1.19	1.22 1.17	1.19 1.15	1.22 1.17	1.21 1.15	1.45 1.41	1.40 1.36
Tensile strength, min., psi	3000	2600	1800	1400	1000	1400	1400	1000	1000
Elongation at rupture, min., per cent	250	300	330	360	360	330	330	250	250
Stiffness, max., psi (at +77 F) (max. min.)	5500 2300	2300 1000	1000 600	600 400	400 250	750 300	800 350	900 700	600 450
(at -40 F)	500,000	350,000	250,000	170,000	60,000	130,000	40,000	130,000	90,000
(at -70 F)	550,000	500,000	450,000	400,000	300,000	300,000	100,000	400,000	360,000
Tear resistance, min., lb. per in.	500	400	300	200	100	200	170	190	170
Brittle temperature, max., (deg Fahr.)	0	-8	-18	-27	-36	-65	-80	-20	-20
Water absorption, max., per cent weight gain plus soluble matter loss soluble matter loss	0.30 0.10	0.40 0.12	0.50 0.15	0.60 0.18	0.70 0.20	0.60 0.25	1.00 0.25	0.50 0.10	0.90 0.20
Flammability (burning rate), max., sq in. per sec. 0.020 in. thick. 0.040 in. thick.	0.3 b	0.4 b	0.5 b	0.6 0.1	0.7 0.2	0.6 0.3	0.6 0.3	0.35 0.15	0.35 0.25
Weight loss on heating (72 hr. at 180 F) max., per cent	1.5	1.7	1.9	2.2	2.4	2.4	2.8	0.55	0.65
Increase in stiffness at 77 F after heating, max., per cent	30	30	30	30	30	35	40	30	30
Increase in brittle temperature after heating, max., deg Fahr.	4	4	4	4	4	10	12	5	5
Dielectric strength (short-time test), min., volts per mil	400	400	400	400	400	300	150	400	350
Thermal stability, max., mg. per g.	2	2	2	2	2	2	2	2	2

^a See Section 6 of ASTM Specifications D 742 for methods of testing.

^b Self-extinguishing.

but proved to be so efficient, so practical, that millions are being made today. Fig. 3 shows them as small, threadless objects producible in a range of colors. When forced onto the valve stems—which are threaded—these elastomeric caps automatically thread themselves. Once applied, they become a seal against extraneous substances that might seep into the stems, causing air to escape and damaging the tires. In one test, a valve stem was loosened to permit leakage, and a plastic cap applied, holding so well that the air did not escape from the inner tube in spite of the fact that the car was driven for several days. Once applied, caps may be screwed on and off at will.

Even smaller are the tiny molded units shown in Fig. 4. They are seals for the holes in distributor caps. When automotive vehicles are shipped overseas, these vent holes must be sealed against moisture and other elements which might attack the working parts of the distributor. These small plastic seals are pushed halfway through the vents, resilient shoulders at top and bottom holding them in place. When the vehicle reaches its destination, the plugs are pulled and the distributor is ready for action.

Gasoline tank vibration dampers (Fig. 5) are another example of improvement by the use of plastics. These dampers fit the necks of gasoline tank filler

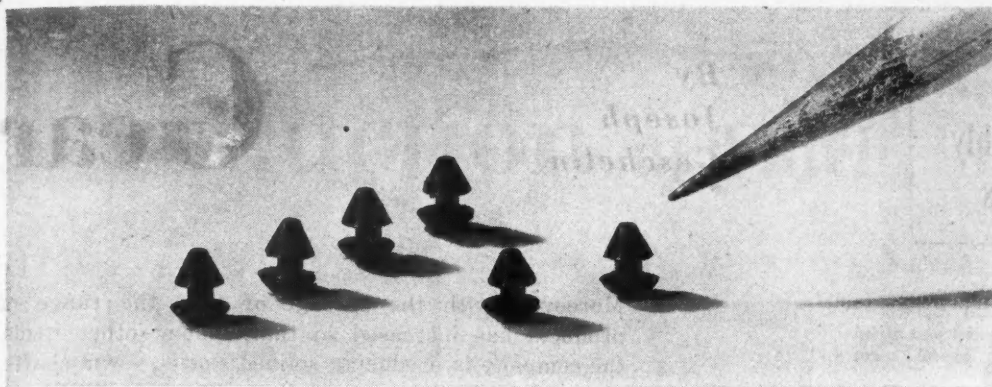


Fig. 4—Tiny seals that keep sea spray and dirt from entering distributor cap vents while automotive vehicles voyage to the war zones.

pipes, at points where they run through the car bodies, cushioning shock and eliminating rattles as the parts vibrate. Under stringent testing, these dampers have proved their capacity of resistance to the effect of gasoline, oils, sunlight, and water. After the war these parts will be color-produced to match the car body and so remove a discordant note present in today's design.

Another important group of products affected by these elastomeric plastics include various types of bumpers, one of which is an elevator door shock absorber.

It includes a molded insert to hold the screw which attaches it to the door. Its function is to soften the repeated shock of door closing, and it must stand up under the shock for lengthy periods without appreciable wear. The piece shown at the bottom of Fig. 6 is a bumper for the rear door ledge of automobiles. A molded thread permits screwing this bumper into the body for secure connection. A small force-fit bumper has been designed to stop both noise and wear of truck hoods as they rattle against the frame of the car. The design of this unit prevents it from working free and so being lost, yet its stem may be compressed for easy removal. The flat bumper at the top of Fig. 6 is for truck-cab doors. In each of these products the

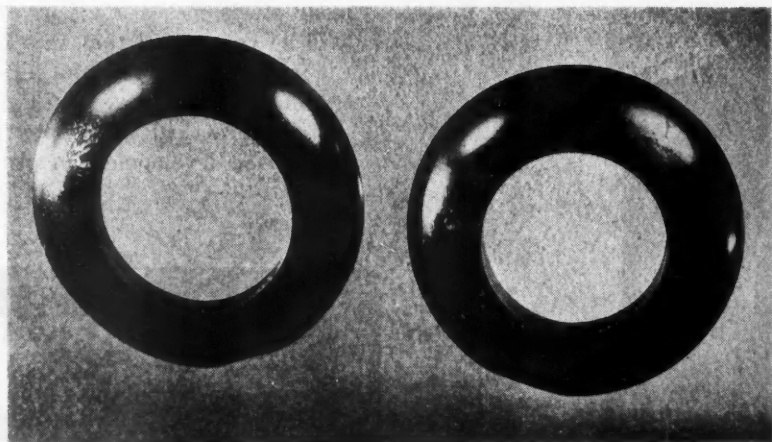


Fig. 5—Gasoline tank vibration dampers. Postwar dampers will be made in matching color.

by the Bay Manufacturing Division is a small indication of the important role elastomeric plastic materials will play in the postwar picture. Plastics make available, for the first time, products that are

resistance of Vinylite plastics to oxidation is as important as their resistance to sunlight, water, and oil.

This summary of present-day applications

easily formed, long-lived, resistant to abrasion, sunlight, moisture, and chemicals—which may be produced in a wide variety of attractive colors. Designers are discovering that Vinylite plastics are not pinch-hitters, but full-time enduring materials that should be specified wherever their unique properties are of benefit.

The presentation of the accompanying photographs has been made to show the wide range of sizes and shapes of which this versatile material is capable and to augment the data given by the author in the foregoing article.—Ed.

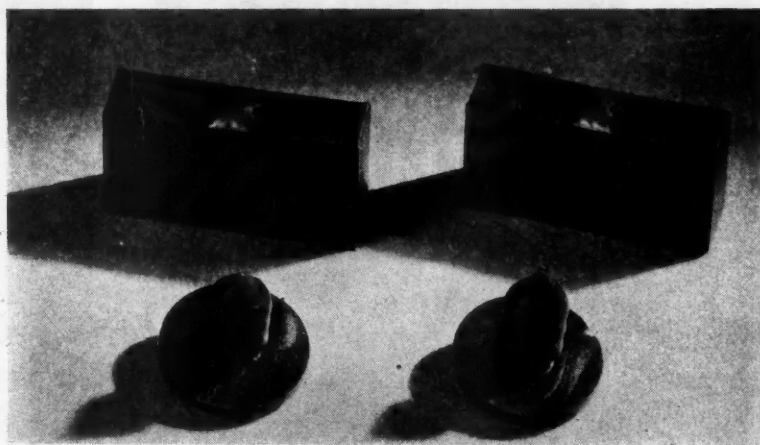


Fig. 6—Top: A flat shock absorber for truck cab doors. Bottom: A bumper for the rear door ledge of automobiles.

**This is the 103rd
in the series of monthly
production features**

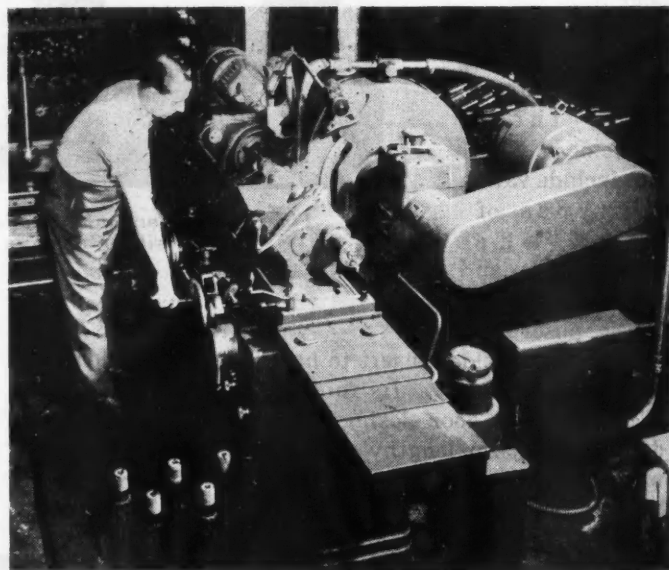
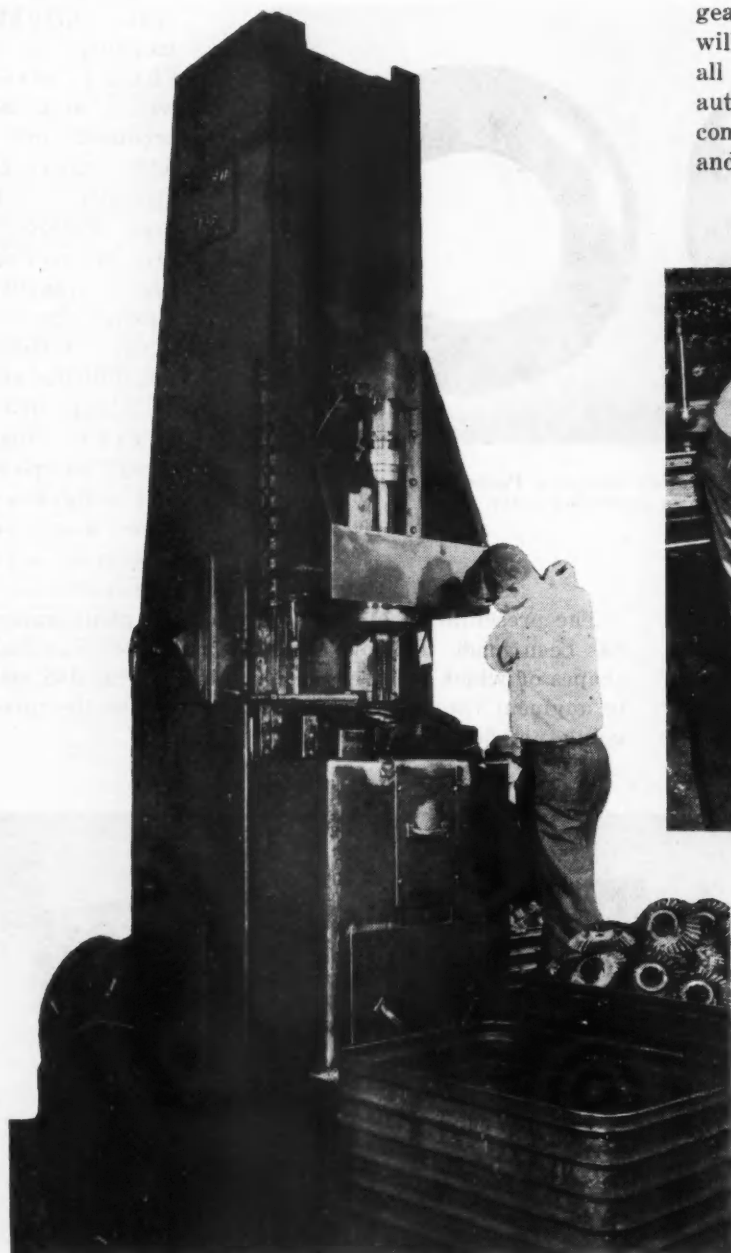
**By
Joseph
Geschelin**

Gear

TO TRACE the beginnings of the Fairfield Mfg. Co. of Lafayette, Ind., you have to go back to 1919 when the organization was founded for the manufacture of differentials, bevel and spur gears. It has come along remarkably since then, being recognized as one of the principal sources of gearing for buses, trucks, tractors, and a variety of industrial equipment.

Moreover, with the passage of time the range of products has increased so that, among other items, the company is producing splined shafts, worm shafts, worm and wheel sets, straight bevel sets, spiral bevel sets, helical spur gears, internal gears, hypoid gear sets, cluster gears, Zerol gear sets, and the Fellows type herringbone gears.

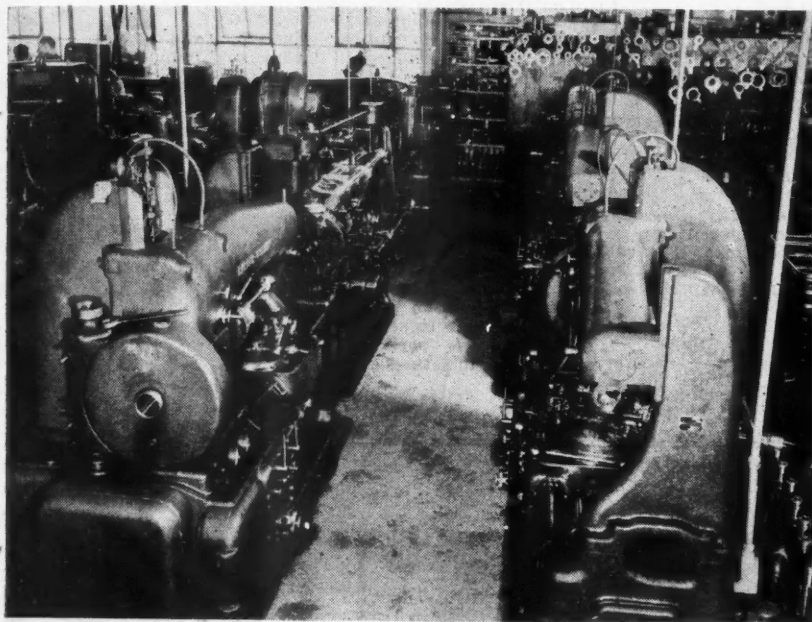
It is estimated that in the course of a year the company routes over its production lines upwards of 2500 different kinds of items. This variability of product combined with the use of steels, ranging from plain carbon, NE types, and the entire series of alloy gear steels, poses a major problem of flexibility. It will be recognized that this is a common attribute of all important parts producers serving the widespread automotive industry. At Fairfield, flexibility has become a practical philosophy in engineering thinking and in the development of production techniques.



(Above) One of the new Cincinnati Filmatic grinders in the finish-grinding department.

(Left) An enormous 50-ton American Broach vertical broaching machine is employed for the broaching of plain and splined gear bores. Other bores are broached in LaPointe horizontal broaching machines in the same department.

Production at Fairfield Plant



Some of the Barber-Colman hobbing machines, including the latest type heavy duty hydraulic equipment.

ress. Manned by competent specialists the metallurgical department has complete control of materials and their treatment. This control begins at the source—the steel mill—extends to forging practice and culminates in the sampling inspection of every lot of steel that enters the plant. The magnitude of the metallurgical problem may be visualized when one considers the range of materials normally employed—from plain carbon steels through the entire series of alloy gear steels—still further complicated by the substitutions imposed by the exigencies of the war. Since each individual part requires specialized heat treat-

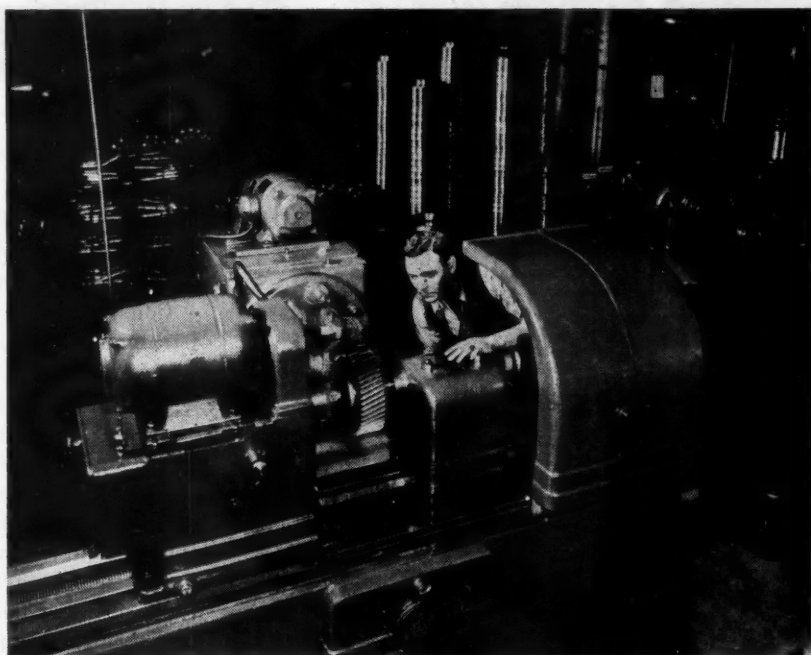
ment, it is not uncommon to find that some parts carry as many as nine different specification sheets to cover the range of substitutions.

In keeping with the current trend in the automotive industry, the criterion of hardenability has been recog-

Over a period of years the art of gear making has progressed from simple concepts to a level of scientific development based upon specialized engineering knowledge. Today the practical solution to any specific gear problem can be uncovered by cooperative effort of the user and the producer. Latest step in this process of constant improvement is the adoption of photoelastic studies in the design of gears and in the development of gear form. This has borne fruit in improved life and freedom from service failures, in production economy and in improved efficiency of gear sets.

Metallurgical development goes hand-in-hand with engineering prog-

Gear shaving is a basic operation on many Fairfield gears. This is an intimate view of the latest and one of the largest of the gear finishers made by the Michigan Tool Co. A smaller, rotary cutter type gear shaver made by Michigan Tool also is found in this department.



Factory Routing—Straight Bevel Gear

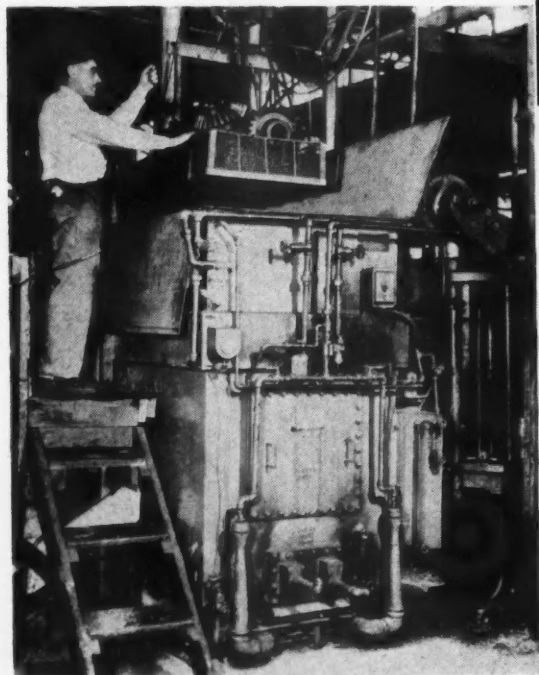
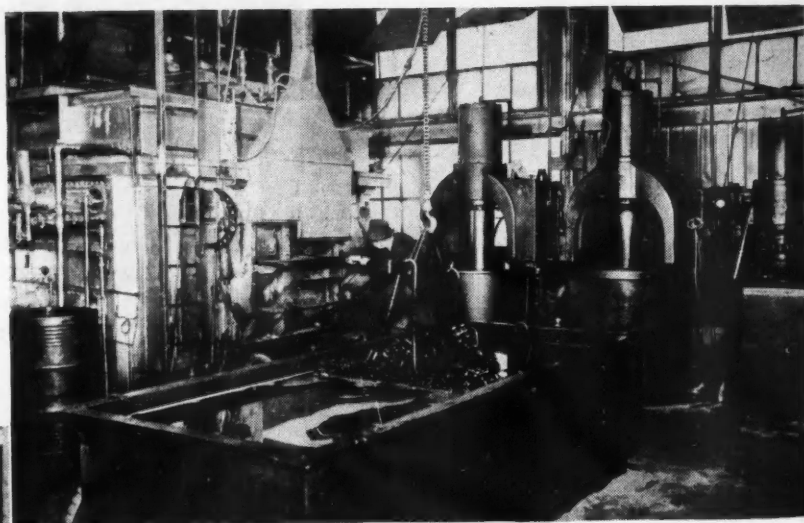
OPERATION AND EQUIPMENT

Center both ends—Lathe.
 Rough turn shank. Leave heat symbols on front face; finish turn shank and stamp heat symbols on back of gear; rough turn angles—Fay automatic lathe.
 Drill, bore & counterbore holes & face front end to first turn size. Chuck on shank—Jones & Lamson turret lathe.
 Harden (to relieve machining strains)—Mahr furnace.
 Degrease—Detrex Degreaser.
 Clean—Pangborn sandblast.
 Draw all over—Homo draw oven.
 Clean—Pangborn sandblast.
 Soft grind front edge of teeth. Locate on back of gear—Blanchard surface grinder.
 Soft grind bore. True up from hub; soft grind counterbore. Locate in bore—Heald internal grinder.
 Soft grind head bearing & shoulder & restamp if necessary. Use 2-piece round arbor; soft grind shank bearing. Use 2-piece round arbor; soft grind thread diameter—Norton external grinder.
 Finish turn angles—Lodge & Shipley Duomatic lathe.
 Finish face front of gear & chamfer. Use fixture—Jones & Lamson turret lathe.
 Rough teeth—Gould & Eberhardt Rougher.
 Finish teeth—12 in. Gleason finisher.
 Burr and stamp; inspect—Bench.

Degrease before copperplate—Detrex degreaser.
 Copperplate—Copper tank.
 Carburize—slow cool—Homo carb.
 Harden—Surface Combustion atmosphere rotary.
 Degrease after hardening—Detrex degreaser.
 Draw partial in lead—Lod pot.
 Draw all over—Homo draw oven.
 Clean—Pangborn sandblast.
 Inspect tooth and surface hardness—Rockwell.
 Grind spot for checking core hardness as indicated on print—Grinding stand.
 Inspect core hardness—Rockwell.
 Break corner of bore hub end. Use hand scraper—Lathe.
 Grind large bearing to first hard grind size (use special arbor that locates in pitch line)—Norton external grinder.
 Counterbore 2.750 diam. at 10 deg (use fixture)—Monarch lathe.
 Grind counterbore (use fixture); grind bore. Locate on large bearing—Heald internal grinder.
 Grind head bearing to final size (use 2-piece arbor); grind center bearing (use 2-piece arbor); grind thread diameter (use 2-piece arbor); grind end bearing (use 2-piece arbor)—Norton external grinder.
 Cut threads—Hanson Whitney thread mill.
 Inspect and mate in sets—Bench.
 Magnetic particle inspection—Magnaflux.
 Test and wire in sets—Test room.

(Right) A section in the heat treating department which operates under the watchful eyes of the metallurgical laboratory. At the left is the Surface Combustion radiant tube fired rotary hearth hardening furnace with atmosphere control. In the background are some of the Gleason quenching machines found here. In the foreground is the agitated solution quenching tank.

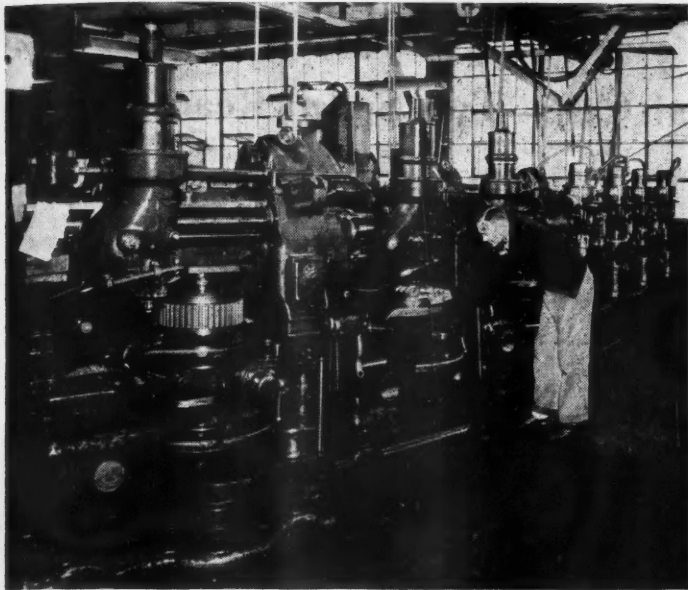
(Below) Close-up of large Detrex degreasing machine used for cleaning all parts in the heat treating department.



nized and is being studied for application. One of the latest studies in which the engineers and metallurgists are engaged is the utilization of the art of shot-peening for the development of maximum fatigue properties.

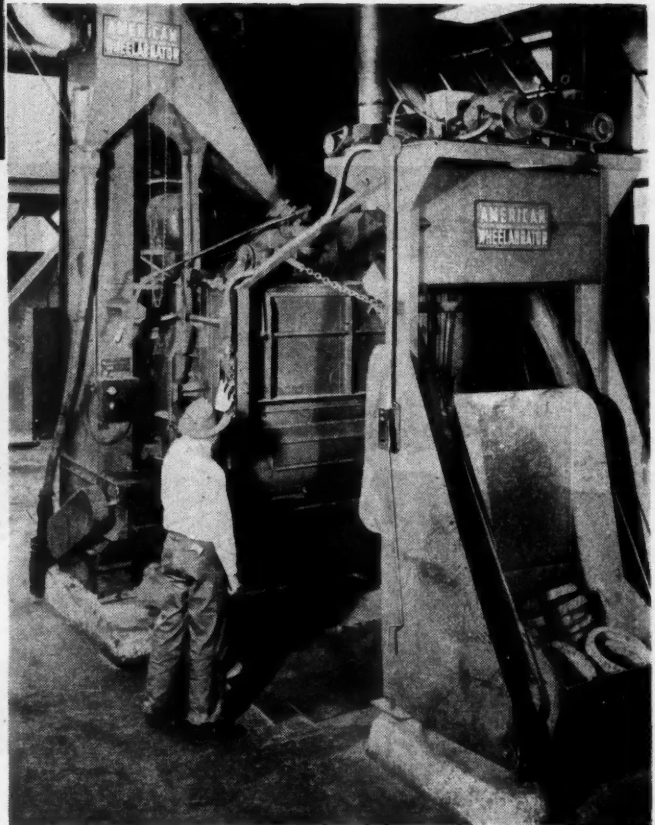
Consider now the manufacturing setup. Flexibility is paramount owing to the wide range of product and the allied problem of relatively short runs. These considerations have been translated in two broad principles—first, the use of universal types of machinery; and second, the establishment of a departmental flow of operations as contrasted with straight-line production.

Although most of the gears and shafts are produced from forged blanks many of the parts, and small differential gears in particular, are produced from bar stock. Initial operations on most gear blanks are the drilling and broaching of the bore to provide the starting point for all succeeding op-



(Left) One of the many rows of Fellows gear shavers of various types and sizes found in the Fairfield plant.

(Below) American Wheelabrator unit in the heat treating department prepares forged blanks for the machine shop after annealing by shot-blasting.



erations. Broaching is done on LaPointe horizontal broaching machines or on a large American vertical broach. These handle the broaching of plain bores and splined bores. Most of the turning is done on batteries of Fay automatics and on Lodge & Shipley Duomatics. This equipment is arranged in separate departments, beginning with automatic screw machines, drill presses, broaching machines, then the Fay automatics and the Duomatics.

Noteworthy wrinkle in machine shop practice is the manner of handling pinion shaft blanks. Each forging, regardless of size, is provided with a deep hexagon impression at the gear blank end. This is then used for driving in the lathe setup. This simple device is effective in solving the ever present problem of work-holding and work driving, thereby aiding production economy.

The next general classification of activity is that of gear cutting. One enormous section contains a

Factory Routing—Straight Bevel Pinion

OPERATION AND EQUIPMENT

Rough turn complete and ream hole and stamp heat symbol letters—4¼ National-Acme Gridley automatic.
Break corner of bore cut off end—Lathe.
Harden (to relieve machining strains)—Mahr furnace.
Degrease—Detrex degreaser.
Draw all over—Homo draw oven.
Clean—Pangborn sandblast.
Broach round hole; broach square hole, clean broach on every piece—LaPointe Broach.
Soft grind front edge of teeth square with square hole—Norton external grinder.
Soft grind back to clean up & restamp heat symbol if necessary—Blanchard surface grinder.
Burr square hole back side—Bench.
Inspect blanks & corners of square for runout on back—Bench.
Finish turn angles; face front side & hold length of bore 2 cuts—Lodge & Shipley Duomatic lathe.
Burr square hole front side—Bench.
Form ¼ in. radius on back angle and polish—Lodge & Shipley Duomatic lathe.

Mill 1/16 in. chamfer front end of square hole—Milwaukee mill.
Inspect blank—Bench.
Rough teeth—Gould & Eberhardt rougher.
Finish teeth—12 in. Gleason finisher.
File four corners of teeth and stamp; inspect—Bench.
Degrease prior to copper plating—Detrex Degreaser.
Copperplate entire gear except teeth—Copper tank.
Carburize—slow cool—Homo Carb Furnace.
Harden—Surface Combustion atmosphere rotary.
Degrease—Detrex Degreaser.
Draw all over—Homo draw oven.
Clean—Pangborn sandblast.
Inspect tooth and surface hardness—Rockwell.
Grind spot for checking core hardness as indicated on print—Grinding stand.
Inspect core hardness—Rockwell.
Burnish square hole—American push broach.
Inspect and mate in sets—Bench.
Magnetic particle inspect—Magnaflux.
Wire in sets—Test room.

Factory Routing—Differential Case—Two Speed Rear Axle

OPERATION AND EQUIPMENT

Tumblast—American Wheelabrator Tumblast.
Paint case all over.
Rough turn OD—Sidney lathe.
Rough and finish inside diameter—Potter & Johnston automatic.
Face end of lugs and turn $8\frac{3}{8}$ diam.—Fay automatic.
Grind end of lugs—Blanchard surface grinder.
Grind radius—Landis radius grinder.
Drill and ream spider holes—Garvin Lathe.

Drill and countersink tapped holes—Natco and 2-spindle.
Tap holes—Avey drill press.

Rough drill (4) $1\frac{1}{8}$ & drill (4) $23/32$ holes; drill (4) $3\frac{13}{32}$ & face bottom; core drill $1\frac{23}{32}$ & ream 1.751 holes; chamfer 1.751 & 0.747 holes & chamfer counterbore—Barnes Drill Co. drill press.

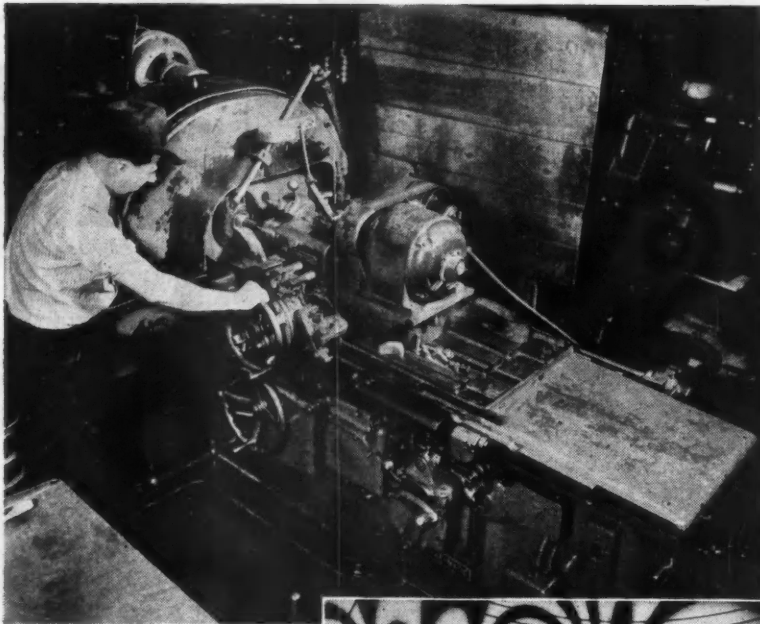
Cut two oil grooves—Cincinnati drill.

Burr complete—Bench.

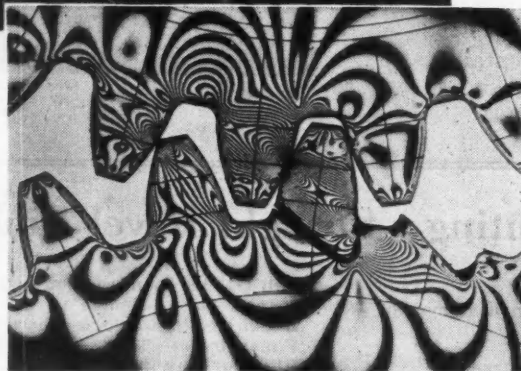
Polish gear seat—Gear seater.

Press four pins into case—American press.

Inspect; assemble complete with internal parts and clutch plate—Bench.

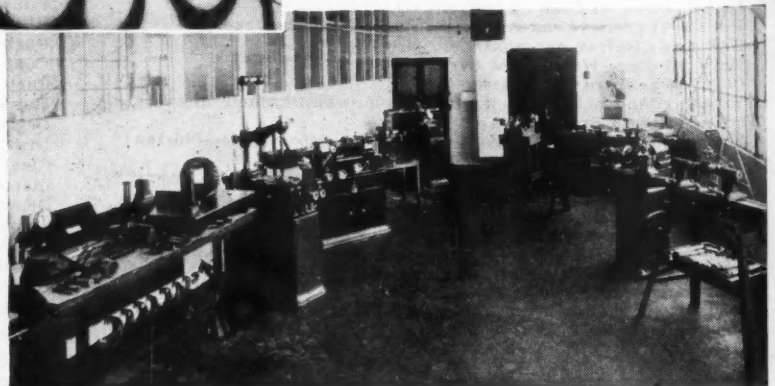


(Above) Another view in the finish-grinding department—a large Heald No. 172 Size-Matic internal grinder used for finish-grinding bores of large gears.



(Center) Heart of the gear manufacturing process is this well-equipped gear laboratory. It includes a full complement of gear checking equipment and other gages and instruments.

(Right) Product of engineering research is this photoelastic study of an experimental gear set under load. Note the distribution of stress and the fracture in the gear tooth.



battery of some 52 Gleason generators of various types including hypoid gear generators and the latest models of the Formate generators for rough- and finish-cutting. This department handles the gamut of spiral bevel gear sets.

Spur gears, helical gears, cluster gears, and splined shafts receive specialized treatment. The larger gears of this type are cut in one operation on new single-spindle G & E machines, having a range from 24 to 48 in. in diameter. Small spur gears and splined shafts are processed in a large Barber-Colman department, containing a battery of the latest Type D hydraulic gear hobbers and Type A hobbers.

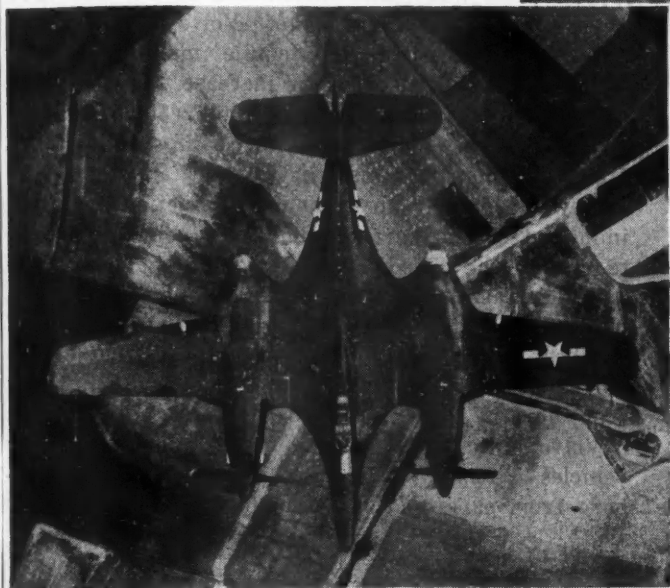
Most spur and helical gears produced on Fellows gear shapers, G & E or Barber-Colman hobbers are shaved in Michigan Tool rotary cutter machines. This setup includes one of the latest and largest Michigan Tool shaving machines capable of handling gears up to 24 in. in diameter.

A large Fellows gear shaper department is fitted with the latest
(Turn to page 50, please)

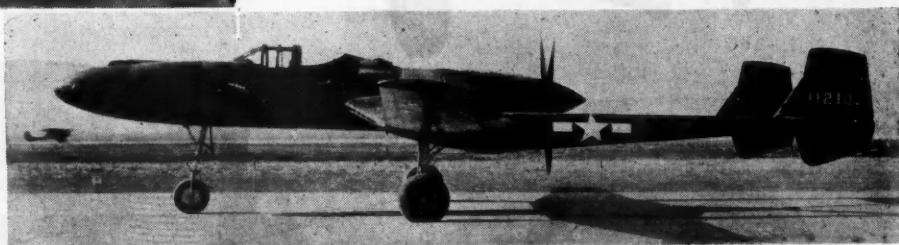
AAF X-Fighter Designs



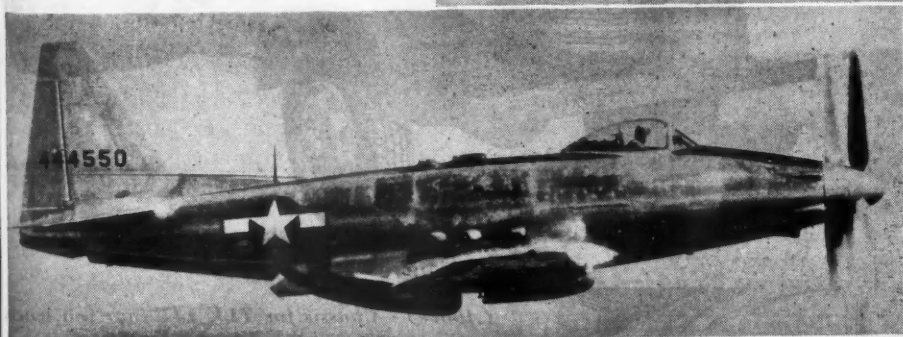
(Above) Curtiss Ascender XP-55, a pusher plane equipped with an Allison 1275-hp engine, is one of several fighter types developed experimentally by aircraft companies for the Army Air Forces for study purposes. Others are shown on this page. Wings in combination with vertical tail surfaces are at the rear and the elevators at the front of the XP-55



(Below) This twin-boomed, pusher type modified flying bomb, the Bell XP-54, has an electric elevator to get in and out of the cockpit. The bottom of the cockpit is hinged and the pilot's seat is raised and lowered electrically. Wing slots are provided for cooling the in-line Lycoming engine. The plane is made mostly of magnesium



(Above) powered by two Continental engines, the McDonnell XP-67 is a long range interceptor-fighter designed with a wing-type fuselage



(Left) General Motors XP-75 is powered by a high output Allison engine and twin counter-rotating propellers.

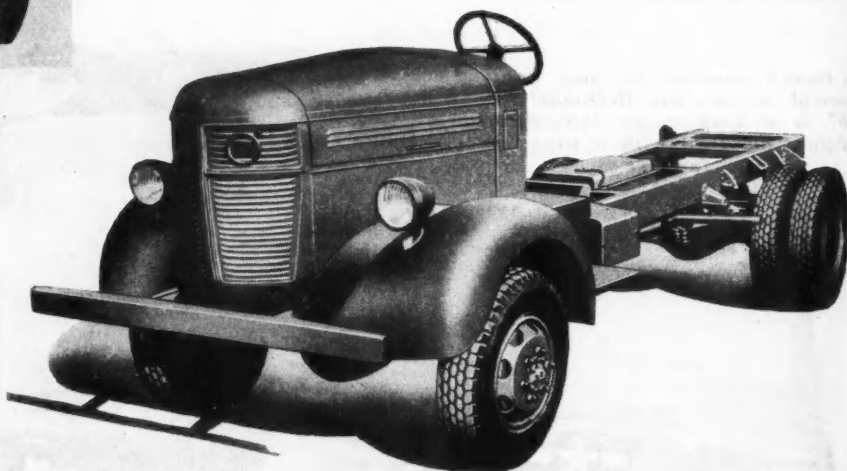
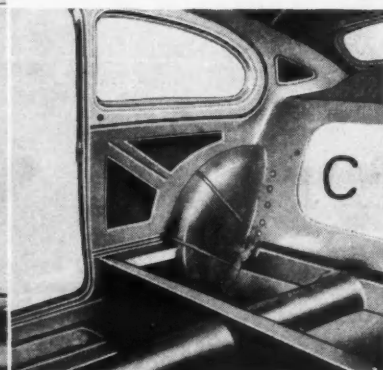
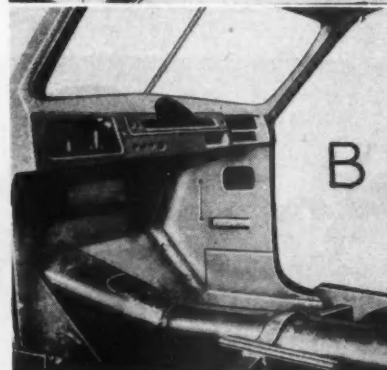
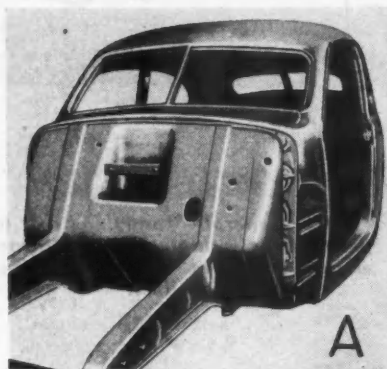
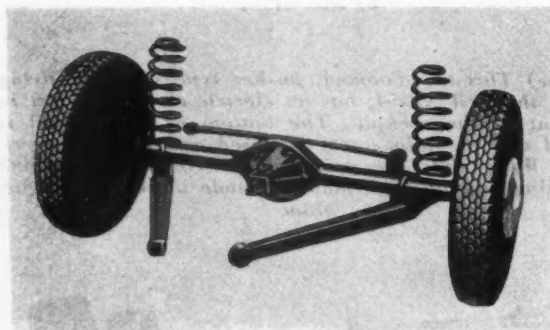


(Right) Bell's XP-77, an all-wood fighter, has a wing span of 27.5 ft and is 22.9 ft long. The engine is an in-line Ranger V-770

Swedish Motor Vehicle Expanding for Postwar

Volvo introduces New Passenger Car and Truck Model at Stockholm Show

THE neutral kingdom of Sweden, the only country which has maintained the production of civilian automobiles throughout the war, is not overlooking the possibilities this unique position presents in regard to increasing the output of automotive equipment for the postwar domestic and export market.



(Above)—Chassis for TLV 141 four ton truck.

(Top Left)—Strut rods and a torque bar, all rubber seated, control the rear axle in relation to the body. Spiral springs give soft frictionless springing.

The self-supporting body, without a frame is shown in illustrations A B C at left, A showing the two beams extending from the dash, which carries the front end of the body. In B and C is seen how the closed shaft for the drive shaft constitutes a powerful backbone which is connected with the walls and floor by a deep crossbeam.

As a step toward the completion of postwar plans formulated throughout 1944, the Aktiebolaget Volvo of Goteborg, principal automobile manufacturer in Scandinavia, has decided to increase the company's capital stock from Kr. 25,000,000 (\$5,952,380) to Kr. 37,500,000 (\$8,928,560), according to a report from the American consul in Goteborg.

New models and an expanded production beginning immediately are part of the Volvo company's plans to corner the Swedish domestic market before the American assembly plants in that country can again begin to operate. Before the war Sweden was one of the best customers of the United States, having imported nearly \$13½ million of automotive equipment from here in 1938.

Volvo automobiles, trucks, buses and other motor vehicles are assembled in the principal plant at Goteborg from parts and sub-assemblies manufactured by

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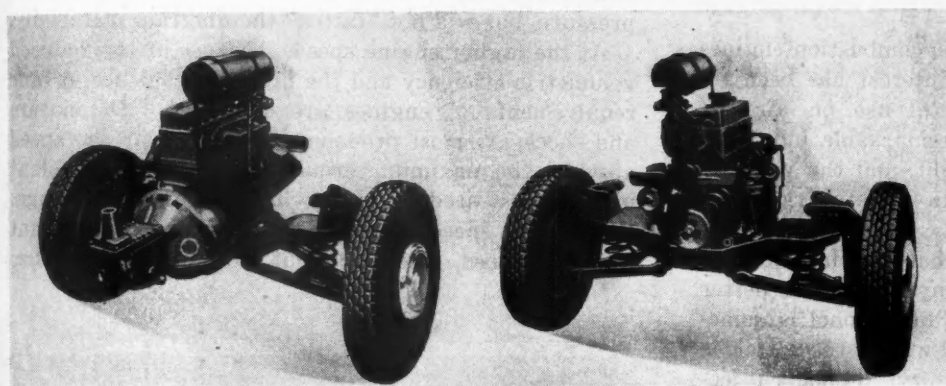
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USTRIES

By
**Eugene J.
Hardy**



(Above)—Exterior view Vol-
vo PV 444.

(Left)—Motor unit and front
wheel suspension constitute
together with front frame
members an easily assembled
unit.

(Below)—Open hood on PV
444 showing front hinge ar-
rangement.

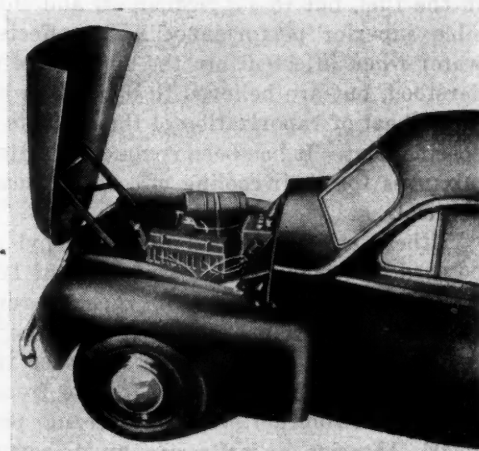
several factories located in different parts of Sweden. Many of these factories are Volvo subsidiaries, but, in addition, some 27 sub-contractors are also under contract to Volvo.

In 1939 the Volvo company had planned a yearly production program of 9000 vehicles, but because of the war actual production was only 7305 vehicles. In 1940 the program was enlarged to an annual production of 12,000 vehicles, consisting of 6000 passenger cars and 6000 trucks and buses. In connection with the increase of the capital stock, the production schedule has been advanced to an annual output of 20,000 vehicles, consisting of 8000 small and 2000 large passenger cars, 8000 trucks and buses, and 2000 tractors.

To carry out this program expansions and changes at the company's subsidiary plants and other connections will be necessary. The greatest expansion will be made at the Skovde plant, where the engines are manufactured, and at Koping, where the gear boxes are made. Only insignificant changes will be necessary at the assembly plant at Goteborg. Certain sub-contractors will have to increase their production if the new program is to be realized.

In 1939, the record year for new registration of motor ve-

(Turn to page 56, please)



Volvo's Comparison of the PV 444 with Passenger Cars of the Same Class in the Peacetime European Market

	Volvo PV 444	Opel Olympia (German General Motors subsidiary)	Fiat 508C	Ford Prefect (British Ford subsidiary)	Volkswagon KDF.
Total length, in.	177	158	157	158	158
Width, in.	61	60	59	57	61
Height, in.	59	62	59	63	61
Wheelbase, in.	102	96	95	94	94
Tread, in.—front	51	43	48	45	50
—rear	51	49	48	45	49 52
Type of engine	4 cyl.*	4 cyl.*	4 cyl.*	4 cyl.†	4 cyl.†
Bore and stroke, in.	2.95 by 3.15	3.15 by 2.91	2.68 by 2.95	2.50 by 3.64	2.75 by 2.80
Piston displacement, cu. in.	36	91	67	71	60
Max. hp at rpm.	43 @ 4000	43 @ 3600	32 @ 4000	34 @ 4000	24 @ 3600
Price, dollars	4800	3555	3950	3575	1200 M
	1120	845	940	852	

* valve-in-head

† valve on the side

Alcohol-Water Injection

for Spark Ignition Engines

By A. T. Colwell

Vice President;

R. E. Cummings

Valve Engineer; and

D. E. Anderson

Consulting Engineer;
Thompson Products, Inc.

INJECTION of water into internal combustion engines is an old practice, in which interest has been revived by its recent successful use on aircraft engines. It has made possible remarkable bursts of power during take-off and in flight, and the value of coolant injection—particularly in supercharged engines—has been fully proved.

Recent tests have indicated that the injection of alcohol or of alcohol-water in many cases gives better results than water injection. While alcohol is somewhat more effective than alcohol-water, the latter is less expensive and quite satisfactory. Coolant injection is not intended to replace good anti-knock quality in the fuel, but to supplement it, and thus make possible superior performance. The effects of alcohol-water when injected into the engine are not fully understood, but are believed to depend on both the high latent heat of vaporization of the coolants, and on their specific heat. It has been common practice to use rich mixtures for their cooling effect, but these are uneconomical.

Either ethyl, methyl or isopropyl alcohol can be used. Alcohol has a heat content of 12,000 Btu per lb, and also supplies some oxygen, in respect to both of which it is a useful addition to the fuel charge. Alcohol, moreover, is soluble in water in all proportions, and it appreciably lowers the freezing point, a 50 per cent solution having a freezing point of minus 25 F. Engine deposits are much softer and more easily removed when coolants are injected, and under conditions of full-load operation over long periods, the engines remain remarkably clean.

The effectiveness of an internal coolant would be expected to be dependent on its latent heat of vaporization. Water has a latent heat of 970 Btu per lb, methyl alcohol of 473, ethyl alcohol of 367, a 50 per cent alcohol-water solution of 675, and gasoline of 135 to 150. It is not conclusive, however, that latent heat of vaporization is the only factor involved.

When used as a motor fuel, alcohol has an octane rating of 90-100, but it seems to have a higher knock-

suppressing value when used as a blending agent. Most of our work has been with special blends of various alcohols, injected with the mixture, but only when required by the engine. Results indicate that the burning characteristics of the charge are altered, the rate of pressure rise and the peak pressure being reduced, and the indicator diagram is "fattened." Water will reduce the rate of pressure rise and the peak pressure, but will not "fatten" the diagram materially.

At the higher engine speeds, because of the reduced volumetric efficiency and the higher turbulence, octane requirements of engines are decreased. Detonation and shock are most pronounced at and near the speed at which the maximum torque is developed, and coolant injection is needed most within this speed range. Beyond this speed range the supply of injected coolant can be reduced, or entirely cut off. In truck service,

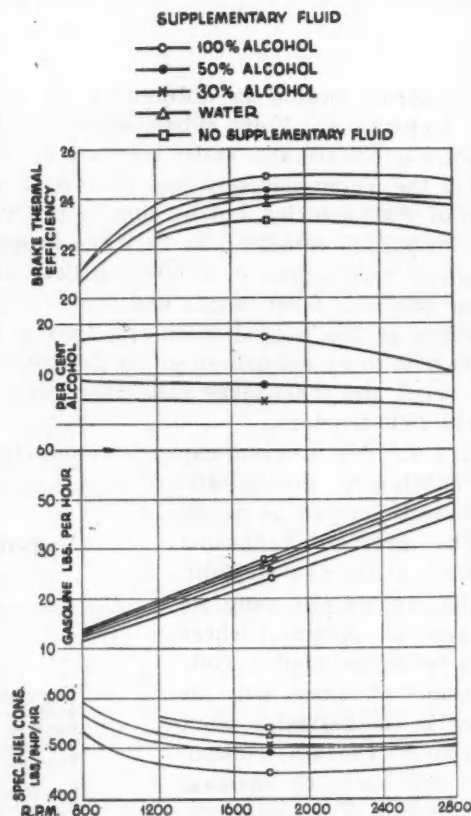


Fig. 1. Engine performance with various internal coolants or supplementary fluids

This article is based on the paper, "Alcohol-Water Injection", which was presented by Messrs. Colwell, Cummings and Anderson at the 1945 War Engineering-Annual Meeting of the Society of Automotive Engineers and SAE Section meetings.

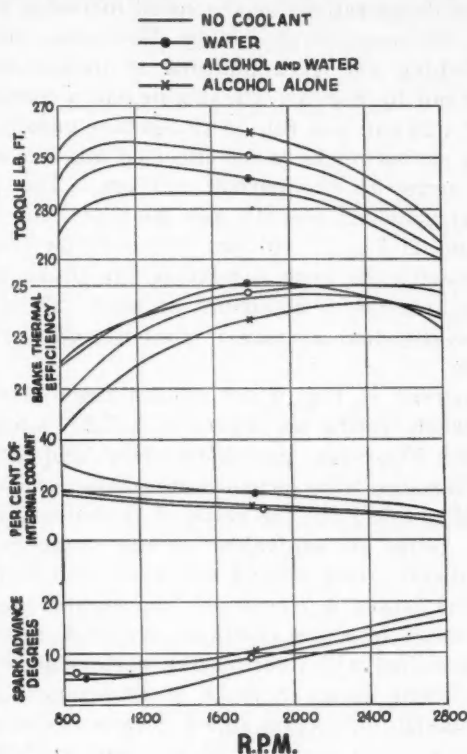


Fig. 2. Engine performance with water, alcohol and a 50-per cent alcohol solution used as internal coolants

however, it may be found advisable to continue coolant injection into the higher speed range, to prevent pre-ignition under severe operating conditions.

Alcohol-water injection allows the use of a lower octane fuel than that normally required by the engine; alternately, it allows the octane requirement of the engine to be raised, for greater economy and performance. Aircraft fighter pilots have reported smoother engine performance with alcohol-water injection. There has been some apprehension that water injection might cause corrosion, but in this connection it must be remembered that one gallon of water results from the combustion of every gallon of gasoline burned, so that water vapor is already present in the cylinder. Moreover, alcohol-water is injected only while the engine is hot and therefore should be completely vaporized, in which condition it does not promote corrosion. Higher compression ratios ordinarily require the addition of weight to the lower part of the engine. Shock control by coolant injection may permit of increasing the compression ratio without adding such weight.

Relative Effectiveness of Alcohol and Water

A series of tests was carried out on a six-cylinder 217-cu in. passenger car engine with a 6.5 compression ratio, to determine the relative effectiveness of water and alcohol solutions of different strengths,

from the standpoints of power and economy. Fuel of 64 octane rating was used, and the results, which are plotted in Fig. 1, show that a 50 per cent solution is best, particularly when the present price of alcohol is taken into account. With this coolant, the percentage of alcohol in the fuel mixture (excluding the water) varied from 5.5 per cent at 2800 rpm to 9 per cent at 800 rpm, and the maximum brake thermal efficiency was 24.4 per cent. With water injection the brake thermal efficiency is lower than with alcohol or alcohol solutions, but this would not necessarily be true for all engines. It is higher, however, than without any internal coolant.

After these tests had indicated that a 50 per cent alcohol solution gave optimum results, further tests were carried out on a 318-cu in. heavy-duty truck engine of 7.25 compression ratio, with 69.8 octane gasoline, to ascertain the relative merits of three internal cooling media—water, alcohol, and the 50 per cent solution. The torque curves in Fig. 2 show that alcohol injection results in the highest torque, injection of 50 per cent solution in next-to-highest, followed by water injection and operation without internal coolant, in the order named. There is not much difference in brake thermal efficiencies with water and with alcohol-water respectively, but at 1200 rpm the engine torque is 9 lb-ft (3.5 per cent) greater with alcohol-

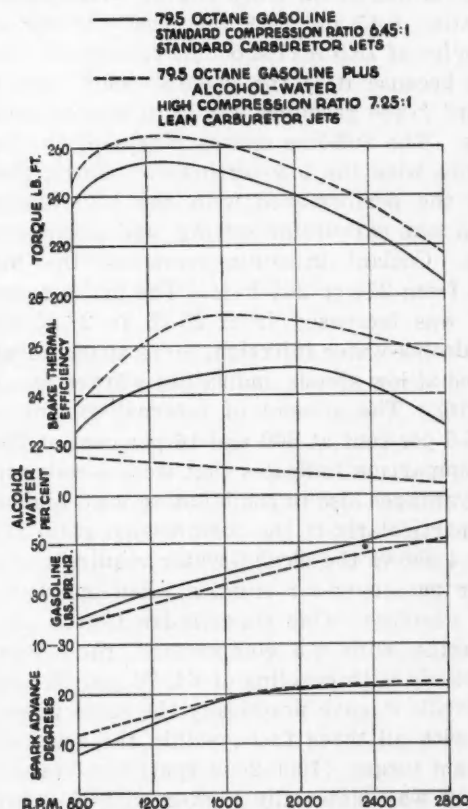


Fig. 3. Effect of alcohol-water injection on the power and efficiency of an engine operating on high-octane gasoline

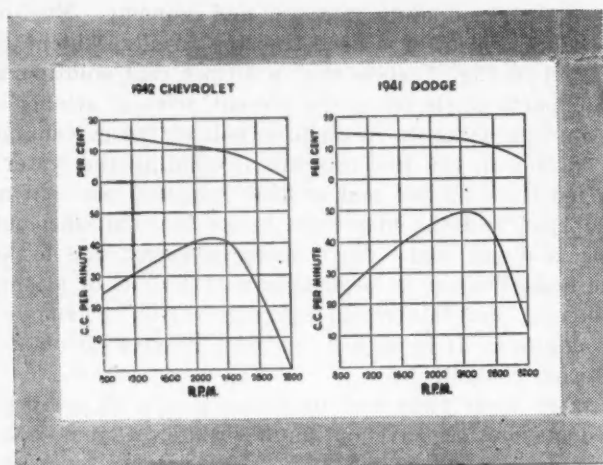


Fig. 4. Alcohol-water requirements of two passenger-car engines

water injection. The spark advance required was practically the same with water as with alcohol-water, but for the same degree of detonation-suppression, roughly 50 per cent more water than water-alcohol had to be injected. If alcohol alone is injected the torque is increased by as much as 13 per cent, but the brake thermal efficiency is lowered one per cent point.

Fig. 3 shows what can be accomplished with alcohol-water injection in the way of increasing output and efficiency. A 318-cu in. truck engine with two compression ratios, 6.45 and 7.25, was used. It was operated on gasoline of 79.5 ASTM octane rating, this fuel being chosen because it is the general belief that postwar standard grade gasolines will be of approximately this quality. The full-line curves represent the best performance with the low compression ratio, the dotted curves the performance with the high compression ratio, a lean carburetor setting, and alcohol-water injection. Coolant injection increased the maximum torque from 254 to 265 lb.-ft. The brake thermal efficiency was increased from 25.15 to 27.25 per cent. With alcohol-water injection, more spark advance was required at low speeds, indicating a lower rate of pressure rise. The amount of internal coolant required was 25.5 per cent at 800 and 16 per cent at 2800 rpm. This comparison indicates that alcohol-water injection has advantages also in combination with higher octane fuels, particularly if the compression ratio is high.

Fig. 4 shows the alcohol-water requirements of two popular passenger-car engines when operated on 64-octane gasoline. One six-cylinder L-head passenger-car engine with 6.5 compression ratio was tested successively with gasoline of 64, 72 and 76-octane rating. While it gave practically the same power at top speed with all three fuels, within the speed range of maximum torque (1000-2000 rpm) the brake thermal efficiency was materially higher with 76-octane than with 64-octane fuel, from which it may be concluded that this engine requires a fuel of at least 76 octane if coolant injection is not used. The curves of Fig. 4 also indicate what would be the proper flow rates of an automatic injection device or a dual-fluid car-

buretor. It will be noted that the flow rate reaches a maximum about the middle of the engine speed range, and then drops rapidly as the speed increases further.

That the practice of cooling the engine internally by enriching the fuel mixture is uneconomical is brought out by Fig. 5. The engine had a compression ratio of 7.25 and was run on 79.5-octane gasoline. The full-line curves relate to the enriched mixture and the dotted curves to the normal mixture. The proportional enrichment was 17 per cent at 800, 26.5 at 1600, and 20.7 at 2800 rpm. It will be seen that whereas with the normal mixture the brake thermal efficiency reaches a maximum of about 27 per cent, with the enriched mixture it does not go above 21.5 per cent.

The curves of Fig. 6 are plotted from results obtained when testing an engine with 7.25 compression ratio with 79.8-octane gasoline without, and with 69.8-octane gasoline with alcohol-water injection, and are intended to bring out the value of alcohol-water injection in terms of equivalent octane numbers. The standard carburetor setting was used with both fuels. As far as power is concerned, the curves show that alcohol-water injection combined with the use of the low-octane fuel will improve the performance of the fuel the same as an increase of 10 octane numbers, if the quantity of coolant injected varies between 21.5 per cent at 1200 rpm and 10 per cent at 2800 rpm.

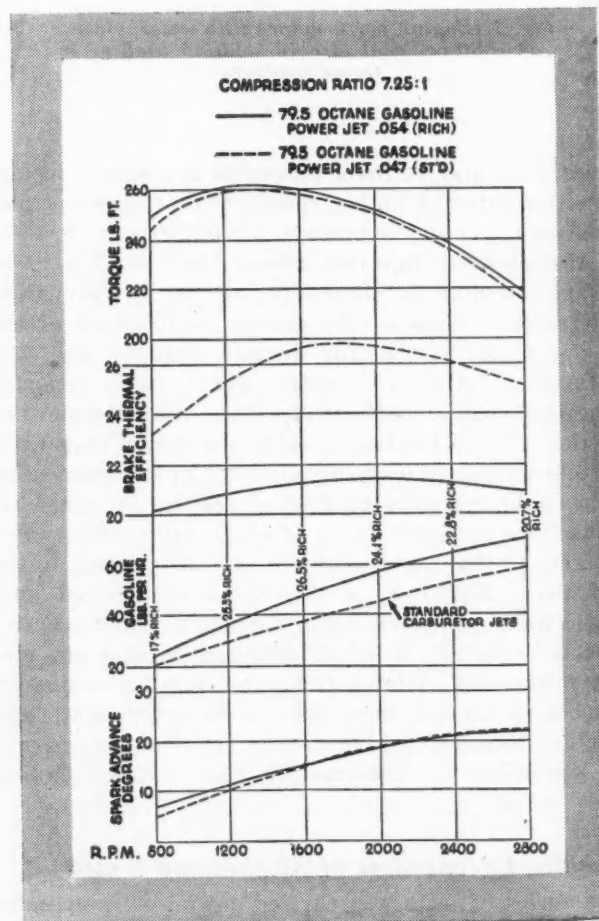


Fig. 5. Effect of richening mixture for cooling purposes on the fuel consumption and brake thermal efficiency

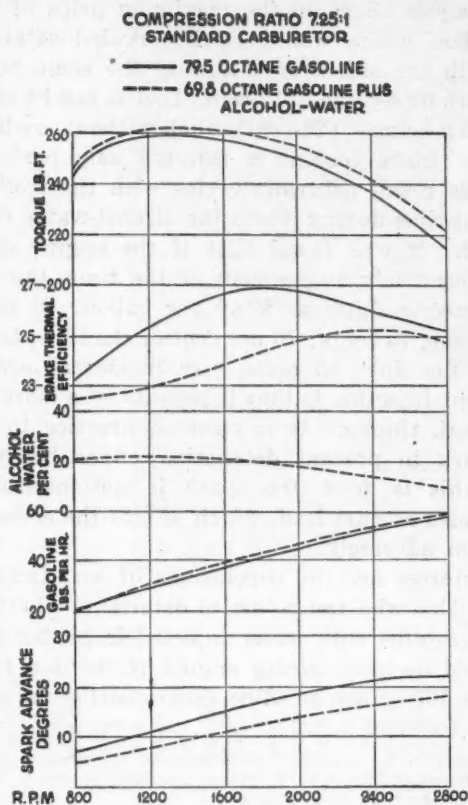


Fig. 6. Comparison of engine performance on low-octane gasoline with alcohol-water injection with performance on high-octane gasoline without coolant injection

The brake thermal efficiency is lower for the low-octane fuel, which is due to the fact that the mixture is too rich when alcohol is drawn in with the gasoline.

Fig. 7 is a cross section of an alcohol-water injector recently developed. It consists of the body casting

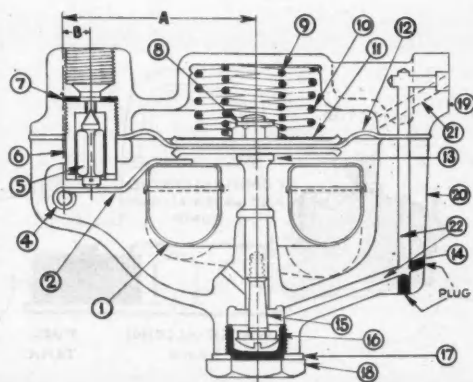


Fig. 7. Cross section of injector

20, the cast cover 19, the diaphragm assembly 12, springs 9 and 10 forming part of this assembly, float 1 of doughnut type, and the metering pin 15, which is actuated by the diaphragm. The diaphragm also acts as a gasket between the body and cover.

As the engine power is reduced and the manifold vacuum increases in consequence, the diaphragm is pulled upward and takes the metering pin with it, which in turn decreases the orifice area. During the first 30 per cent of diaphragm travel, only spring 9 is active. To meet engine requirements, the first part of the flow curve must show an increase in flow rate, but a diminishing rate of increase. The flow rate depends on the manifold vacuum, the spring rate, and the orifice area. Manifold vacuum increases from a few inches of water to 25 in. of mercury, and the change in vacuum in combination with the pressures

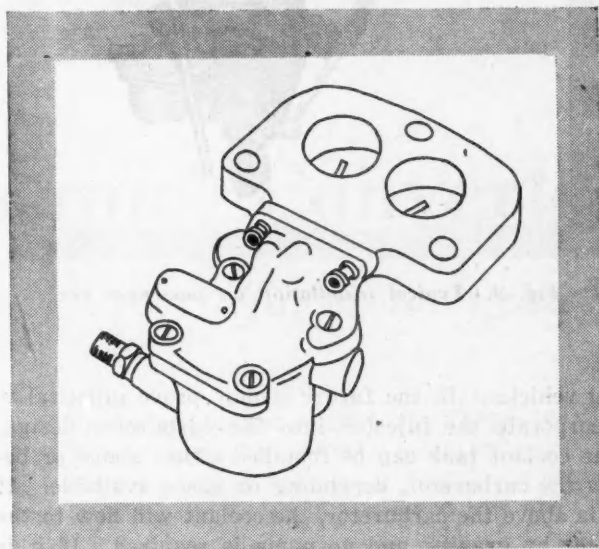


Fig. 8. Injector mounted on flange

of springs 9 and 10 positions the metering valve so that the desired flow rate is obtained. Spring 10 becomes active only after the diaphragm has moved through 30 per cent of its range; it increases the spring rate, thereby decreasing the flow rate as engine power is reduced, and finally valve 16 contacts its seat and shuts off the flow completely. When engine power is increased the various events follow one another in the reverse order.

The interior of the injector body communicates with the manifold through the inclined passage 21, which terminates on the face of the mounting flange. The coolant, after passing through the metering orifice, flows through passages 22, which communicate with nozzles in the mixture tubes shown in Fig. 8. A simple nozzle with a single central orifice proved most efficient. Fig. 8 shows the injector mounted on a flange, which is placed between the carburetor and intake-manifold flanges. A typical passenger-car installation is shown in Fig. 9.

The above description covers installations on exist-



Fig. 9. Typical installation on passenger car

ing vehicles. In the future it may prove practical to incorporate the injector into the carburetor design. The coolant tank can be installed either above or below the carburetor, depending on space available. If it is above the carburetor, the coolant will flow to the latter by gravity, and no pump is required. If it is mounted below the carburetor level, as will probably be necessary where considerable quantities of coolant must be carried, a pump will be required, and might well be combined with the fuel pump. Fig. 10 is a schematic drawing of a truck installation, showing the alcohol-water tank mounted adjacent to the fuel tank. Actual service experience indicates that the capacity of the coolant tank need not exceed 10 per cent of that of the fuel tank. The coolant pump should produce the same pressure as the fuel pump, but have a much smaller capacity.

All metals and other materials that are contacted by the alcohol solution should be non-magnetic and non-corrosive. Dissimilar metals preferably should not contact. All non-metallic materials should be impervious to the alcohol solution, and swelling, shrinkage or change of more than 10 per cent in the durometer reading cannot be tolerated. General experience has been that water suitable for drinking is satisfactory for use with this device. However, in a few cases a slime formed which interfered with the proper functioning of the apparatus. This trouble in every case was completely eliminated by the use of distilled water.

In an analysis of costs, the price of gasoline was

arbitrarily set at 20 cents per gallon for the 79.5-octane grade and at 17 cents for the 69.8-octane grade. The analysis bears on the maximum price of alcohol per gallon which would justify alcohol-water injection with the object of obtaining the same performance with 69.5-octane (17-cent) fuel as can be obtained with 79.5-octane (20-cent) fuel without coolant injection. Since coolant is injected only part of the time, the result naturally varies with the fraction of the total time during which the alcohol-water is being injected. It was found that if the engine operates at full load only 10 per cent of the time, the alcohol might cost as high as \$2.00 per gallon; 40 per cent of the time, 74 cents; 70 per cent of the time, 56 cents, and all the time, 50 cents. An incidental advantage of coolant injection is that it permits of a more favorable spark timing. It is common practice to retard the spark to prevent detonation under heavy load. When this is done, the spark is automatically retarded also at part load, which affects the economy of operation adversely.

Of interest are the conclusions of an aircraft engine builder who ran a test to determine whether 87-octane gasoline with water injected in proper quantities could be used during engine production tests to conserve 100-octane gasoline. Some conclusions reached were as follows:

1. Engines can be operated satisfactorily up to and including take-off conditions on 87-octane gasoline provided water is added to the induction charge.
2. The amount of water necessary to suppress detonation is approximately 20 per cent to 30 per cent of the total liquid charge (fuel plus water by weight).
3. Without water addition, the engine can be run up to approximately 40 in. Hg manifold pressure on 87 octane gasoline without experiencing detonation in low supercharger gear (beyond this point it is necessary to enrich the mixture or add water to prevent excessive temperatures).
4. The general characteristic of adding water to the charge is to increase the power with constant manifold pressure. If the power is kept constant, the required manifold pressure decreases. This condition is believed to be brought about by the water reducing the charge temperatures, thereby increasing the volumetric efficiency.
5. A check on the effect of water addition using 100-octane gasoline was first investigated. Power was checked with 100 octane gasoline at three conditions of high-output performance and then the same checks were made adding water through the carburetor elbow ahead of the supercharger. An amount of water equal approximately to 20 per cent of the total liquid charge (fuel plus water by weight) was added. The effect of the water in each case was to increase the power output at constant manifold pressures.

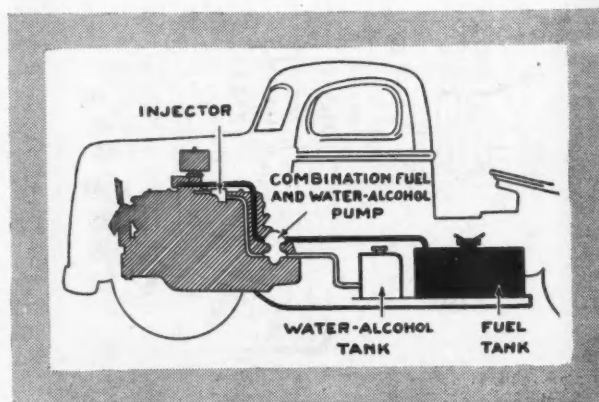
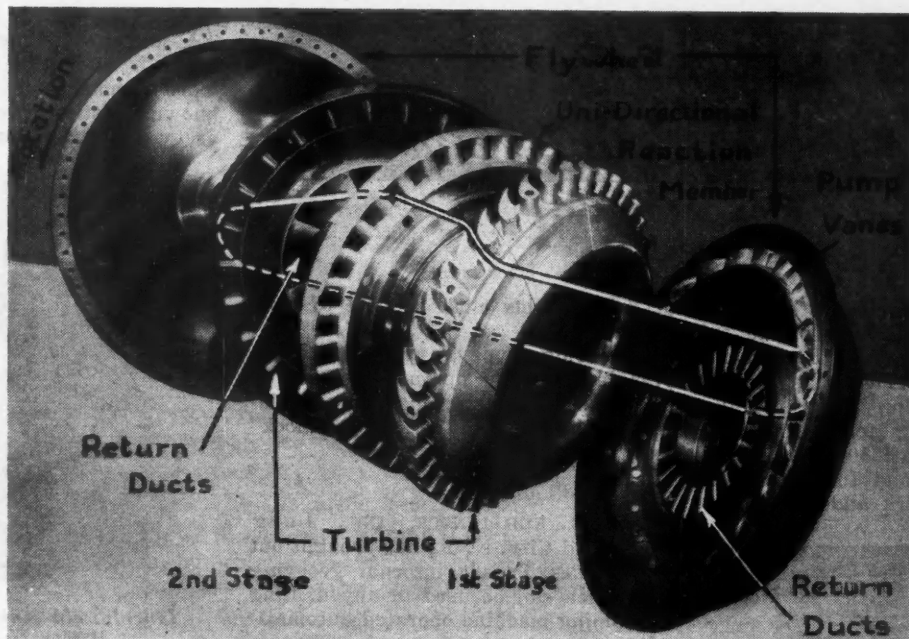


Fig. 10. Schematic drawing of alcohol-water injector installation on a truck



Brockhouse

Hydro-Kinetic Torque Converter

for Motor Vehicles

By M. W. Bourdon

Special Correspondent of
AUTOMOTIVE and AVIATION
INDUSTRIES in Great Britain

ADDRESSING the British Institution of Mechanical Engineers in 1935, Prof. F. C. Lea expressed the opinion that the problem of combining an hydraulic clutch with an infinite-ratio gear was practically insolvable. Three years later, in August, 1938, in a paper read before the British Association for the Advancement of Science, Professor Lea retracted his earlier statement, and said that tests of a certain example of hydro-kinetic torque converter had convinced him that the problem had been satisfactorily solved and that within the range of torque variations requisite in cars, trucks and buses the device functioned effectively as a clutch and variable speed gear.

The torque converter referred to has been further developed since it caused Professor Lea to retract the opinion he expressed in 1935 and is now known as the Brockhouse Turbo Transmitter, for the Brockhouse organization, which combines a large number of British engineering concerns, has acquired the manufacturing rights for one of the companies it controls. Particulars of this device recently released in England have been accompanied by an announcement that it is being installed on a number of new Crossley buses ordered by the Manchester Corporation Transport Department after prolonged test of an example under normal service conditions. It is said also to

have been under test since 1938 in a 27-hp (100 max. bhp) Humber car covering 63,000 miles, and since 1939 in a Ford V8 with a mileage of 50,000. It has also been installed and tested in various trucks, light and heavy.

As made hitherto, the Turbo Transmitter gives a maximum of 3.8 times engine torque with the output shaft stalled, full throttle and an engine speed of 2000 rpm; but a slightly modified later design has given a ratio of 4.2 to 1. As and when the output shaft is released and its speed increases, the torque steadily decreases until the speed of the shaft and that of the engine coincide; the output torque is then the same as the input (i. e., that of the engine) and the ratio is 1 to 1.

As indicated in accompanying illustration—an exploded view of the main units arranged in order of assembly—the device comprises (1) a rotary vane pump carried on an extension of the engine flywheel, (2) a two-stage turbine rotor coupled to the output shaft and (3) a reaction member located between the outlet side of the first-stage turbine blading and the inlet side of the second-stage turbine blading. All the units mentioned are enclosed in an oil-tight casing formed by the front and rear halves of the hollow flywheel.

The pump element consists of a ring of inclined vanes in the rear half of the casing; and here it may be emphasized that the precise shape of the blades

(Turn to page 90, please)

New Production Equipment

A LINE of powerful drills with aluminum housings has been placed on the market by The Aro Equipment Corp., Bryan, Ohio. The drills can be equipped with 3/16-in., 1/4-in. or 5/16-in. Jacobs chucks. Model 109 and Model 1010 operate at 2500 rpm.

The models 1013 and 1014 are 4000 rpm for aircraft work and other jobs



Model 109 Aro drill

that require high speed and sustained torque. All tools have perfect balance and are built for 24-hr-a-day production.

Features of these drills include one-piece aluminum housing, built-in oilers, four-bladed rotors, hardened and ground cylinders and four-ball bearing construction. Gears and gear cages are precision cut and ground for perfect alignment.

Standard equipment includes 3/16-in. or 1/4-in. Jacobs Chuck, and 8 ft of 1/4-in. hose and fittings. A 5/16-in. chuck is available at slight extra cost. A 1/4-in. chuck is the largest used with models 1010 and 1014, which are furnished complete with chuck guard.

N. A. WOODWORTH COMPANY, Detroit, Mich., introduces to the industrial field a new clamping jig, the "Cone-Lok," which is constructed to utilize the braking power of perfectly mated male and female cones. It has a minimum of wearing parts and may be assembled or dismantled in a very few moments with no special skill or tools required. The "Cone-Lok" can be converted from right to left hand operation in 2 min. using no additional parts.

All moving parts operate in an oil bath, and exclusive Woodworth design keeps chips and cutting oils from contact with any of the internal parts.

Three styles are being manufactured at present—the three-post, the "up clamp" type and the "bridge" type. The three-post type may be used for most applications found in general machine shop work. The up-clamp type is especially used where depth of counterbore

or drilled holes must be held to close tolerances.

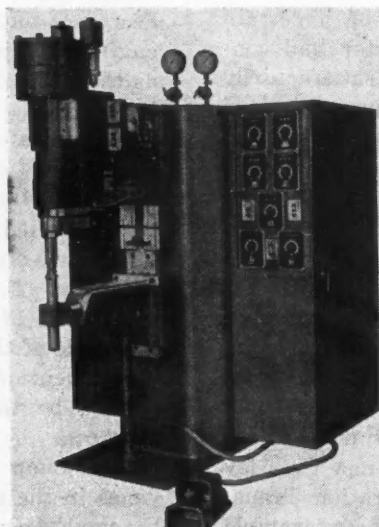
The bridge type is necessary whenever large heavy operations must be performed such as on manifolds, cylinder heads, etc. A special "jack-lock" fixture clamp is also available.

WALDES KOH-I-NOOR, INC., Long Island City, N. Y., has brought out the Waldes Truarc internal grooving tool which can be used in any drilling or reaming machine operated automatically or by hand. A vernier thimble controls the diameter of the groove, and scratching or marring is prevented by a ball bearing housing which holds

Waldes Truarc internal grooving tool

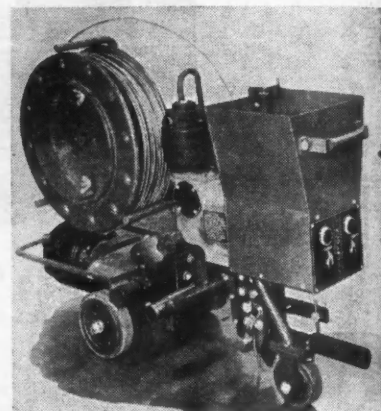


the pilot bushing. An adjustment is provided for spacing recess from either the top or bottom of hole. Cutters are available for cutting multiple grooves of any desired widths in one operation.



Sciaky welder

A NEW type of automatic welding known as "Lincolnweld," a process which is said to be simpler, faster and more economical in operation than any known existing process of automatic arc welding, has just been announced



Lincolnweld unit of the motor driven tractor type

by The Lincoln Electric Company, Cleveland, Ohio.

The process is designed for use with direct current, utilizing a bare metallic electrode which is fed through a granular flux deposited on the joint to be welded. Sufficient flux is applied to completely blanket the arc and the molten metal; the unfused flux is then reclaimed for further use.

Extremely high current densities are used. For example, a 1/8-in. diameter electrode may carry as much as 650 amp. This produces greater penetration and permits smaller cross section of weld metal with resulting saving in cost and reduced warpage and distortion.

SCIACKY BROS., Chicago, Ill., have applied a new "three-phase" principle in the construction of several of their new machines for spotwelding steel in heavy gages. All three phases of the a-c line current are rectified to direct current and supplied to the welding transformer through a system of reversing ignitron tubes. These tubes allow the current to pass through the center-tapped primary of the transformer, first in one direction and then in the other. Thus the induced welding current in the secondary is a continuous alternating impulse of low frequency—said to be of ideal wave shape and magnitude.

The principle has been effectively applied to seam welders for aluminum, heavy duty projection and flash welders.

CONTINUOUS production is obtained on this No. 1-A Roto-Matic milling machine made by Davis and Thompson Co., Milwaukee, Wis. It is designed for the rough and finish milling of the mounting face of a water pump body. Pieces are placed in the 12-station fixture as the drum passes the loading

(Turn to page 85, please)

Cooling Hood for Turbosupercharger

FUNCTIONING primarily as a cooling unit for the turbine section of a turbosupercharger, a hood developed by W. A. Clegern, power plant design specialist at the Consolidated Vultee Aircraft Corp., is reported to improve engine and airplane performance. Details of this new device are shown on this page.

The cooling of the turbine wheels of turbosuperchargers has always posed a knotty problem for power plant engineers, because the wheels had to be rotated by exhaust gases whose initial temperatures ranged from approximately 1600 to 1800 F. Clegern's hood is claimed to solve this problem by providing a cooling cap of the radiation type on the under side of the turbine wheel. Moreover, it provides a duct which conducts the exhaust gases from the buckets or vanes of the turbine wheel to the open air so as to create a jet—

thus eliminating exhaust drag and increasing the speed of the airplane.

In addition to its cooling cap, the Clegern hood comprises outer and inner tubular elements. The outer element serves to expel exhaust gases, while the inner element conveys cooling air from the cap through the hood. This arrangement causes the exhaust gases to create suction within the central tube, forcing the cooling air to circulate more rapidly in the vicinity of the turbine wheel.

Because of its cooling action, the new hood serves efficiently as an exhaust flame damper. Its contours are aerodynamically clean, its weight is unusually light, and its construction is such that it can be readily attached to any standard turbosupercharger.

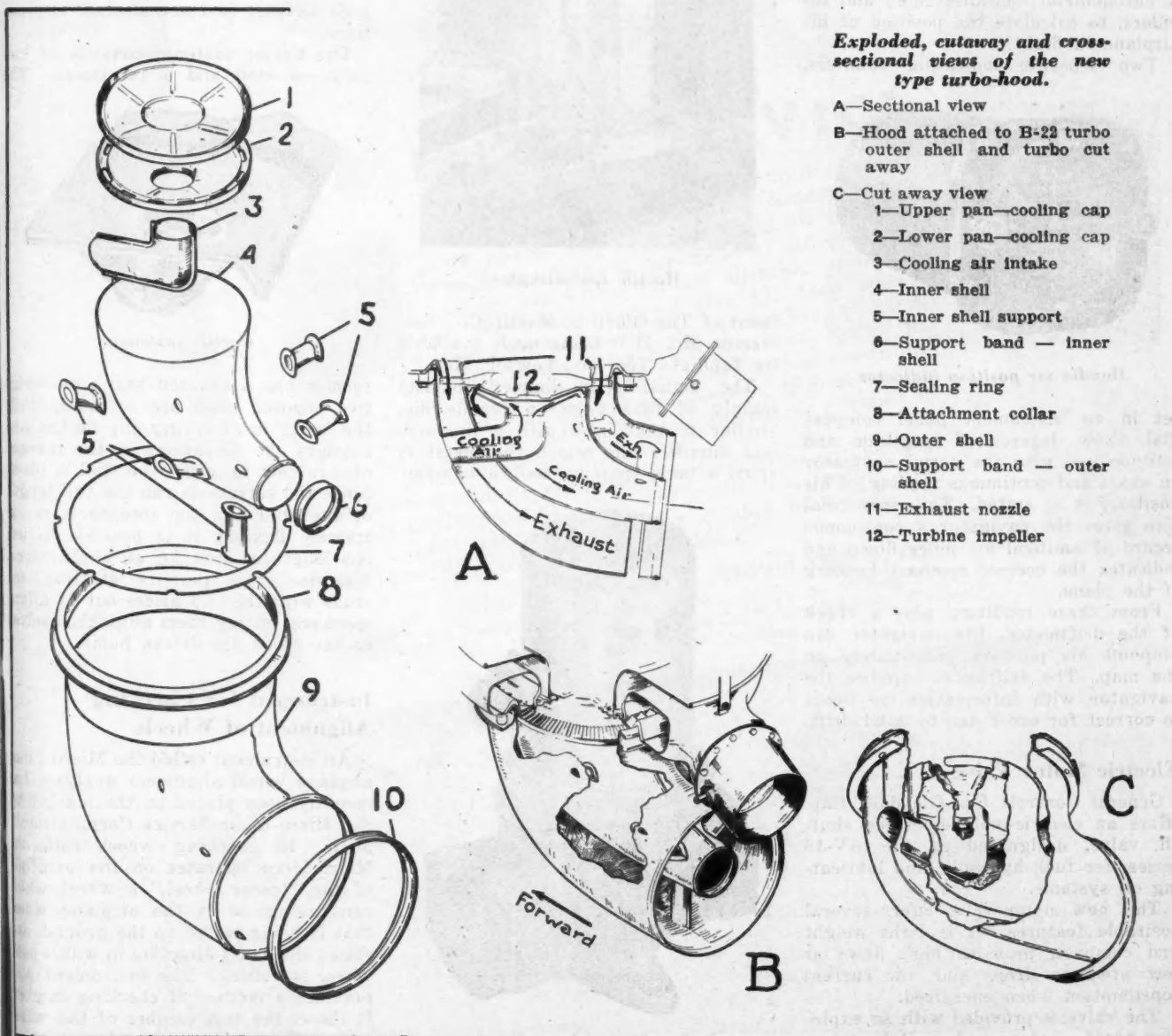
Exploded, cutaway and cross-sectional views of the new type turbo-hood.

A—Sectional view

B—Hood attached to B-23 turbo outer shell and turbo cut away

C—Cut away view

- 1—Upper pan—cooling cap
- 2—Lower pan—cooling cap
- 3—Cooling air intake
- 4—Inner shell
- 5—Inner shell support
- 6—Support band — inner shell
- 7—Sealing ring
- 8—Attachment collar
- 9—Outer shell
- 10—Support band — outer shell
- 11—Exhaust nozzle
- 12—Turbine impeller

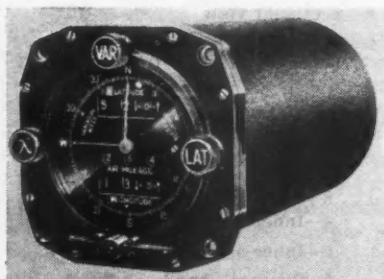


New Products for Aircraft

Air Position Indicator Announced by Bendix

A revolutionary air position indicator which gives continuous readings of latitude and longitude has been announced by Bendix Aviation Corporation. This air position indicator automatically performs all of its computing, calculating and indicating functions within a single self-contained device, about the size of a quart milk bottle, mounted on the instrument panel. The device is said to make calculations which ordinarily would require a navigator to work for hours with charts, basic navigational reference books, star-sighting sextants, a chronometer, parallel rules and dividers, to calculate the position of his airplane in flight.

Two separate indicating counters,



Bendix air position indicator

set in an instrument panel compass dial, show degrees of longitude and latitude and give the aerial navigator an exact and continuous reading of his position, it is stated. This same dial also gives the navigator a continuous record of nautical air miles flown and indicates the correct compass heading of the plane.

From these readings, plus a check of the driftmeter, the navigator can pinpoint his position immediately on the map. The driftmeter supplies the navigator with information he needs to correct for error due to wind drift.

Electric Motor Valve

General Controls Co., Glendale, Cal., offers an electric-motor-operated shut-off valve, designated as the AV-16 series, for fuel, hydraulic and lubricating oil systems.

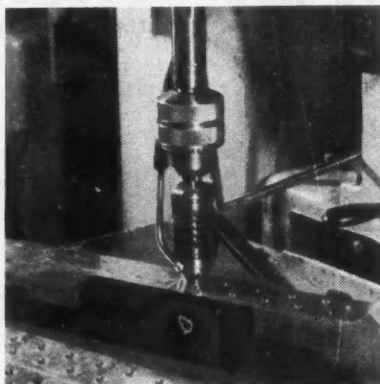
This new motor valve offers several desirable features. It is light weight and compact, provides high flows at low pressure drops and low current consumption when energized.

The valve is provided with an explosion-proof motor and switch cover,

standard Army-Navy or terminal-type electrical connections, and tube or flange fluid connections 1/4-in. to 3-in. I.P.S.

Tool for Dimpling Hard Sheet Metals

A tool for dimpling hard and brittle sheet metals such as Reynolds 301-T, Alcoa 75-ST and the new lightweight magnesium alloys is a recent develop-



Martin spin-dimpler

ment of The Glenn L. Martin Co., Baltimore, Md. It is being made available by Topflight Tool Co., Towson, Md.

The actual spin dimpler consists mainly of four parts—a female die, similar to that used with a pressure pad dimpler, into which the metal is spun, a male spinning tool, a trimmer



Series AV-16 shut-off valve

cutting edge to remove any metal which is extruded upward during the forming of the dimple, and a pressure pad assembly for holding the sheet in place during dimpling. The spinning tool, itself, has several projections which are rounded off to eliminate machining of the metal from the inside of the dimple.

In operation, the spin dimpler is adaptable to any drill press capable of supplying 1500 rpm rotation. Exact centering of the dimple is assured by a tip on the spinning tool exactly fitting the inside diameter of the rivet hole.

Self-Aligning Fastener

A lightweight, self-aligning, spring-loc fastener of unique design has been developed by The Glenn L. Martin Company, Baltimore, Md., and will soon be made generally available. Known as the Carlso, the new fastener was originally designed to overcome difficulties in the attaching of aircraft cowlings, but has since demonstrated its adaptability as an all-purpose fastener for both aircraft and non-aircraft applications.

The Carlso fastener consists of two parts—a stud and a receptacle. The



Carlso fastener

former has a squared shank on which two opposed sides are serrated, while the latter is of spring clip design and engages the serrations in the manner of a ratchet to secure the stud in place. Since the serrations run the full length of the stud and the receptacle is extremely flexible, it is possible to use one length of stud for all applications. Likewise, this permits starting the studs with the two pieces out of alignment and letting them align themselves as the studs are driven home.

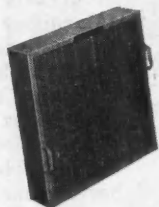
Instrument for Checking Alignment of Wheels

An instrument called the Micro-Linor airplane wheel alignment analyzer has recently been placed on the market by the Micro-Linor Service Corp., Detroit, Mich. In checking wheel roll, the Micro-Linor operates on the principle of the "tracer wheel," a wheel which runs alongside of the airplane wheel that is being tested on the ground, and shows the exact direction in which each wheel is rolling. The instrument also provides a method of checking camber. It shows the true camber of the wheel

(Turn to page 80, please)

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New Products

New Electrode for Heavy Weldments

A new heavily covered arc-welding electrode for flat and horizontal fillet welding as well as for flat butt welding has been announced by the Electric Welding Division of the General Electric Company. Desirable wherever weld requirements include high mechanical properties, rigid X-ray examination, good profile, high deposition rate, and good surface appearance, the applications of this electrode include pressure vessels and pertinent connections, heavy machine bases, and structural parts such as column plates, columns, roof trusses, beams, and girders where the thickness of the section permits.

Known as Type W-27, the new electrode is characterized by an exceptionally high melting rate which is said to result in increased production and higher speeds at the same welding current as other electrodes. At comparable production speeds, Type W-27 requires less heat input to the joint, thus reducing warpage and internal cooling stresses.

New Type Crane with Full-Vision Cab

The Unit Crane & Shovel Corp., Milwaukee, Wis., is building a crane with a full-vision cab which affords the operator an unobstructed view in all directions at all times. The design of this cab has been accomplished without sacrificing weight, capacity, or head room and made possible by the compact design of Unit main machinery.

This self-propelled, one-man operated crane is powered by a single engine, either gasoline or Diesel, and is



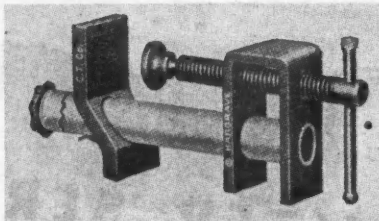
Unit crane with full-vision cab

equipped with an all-purpose, jib-extension boom for multiple yard operations.

The rated lifting capacity of the crane is 5 to 7 tons from the 30-ft. straight lattice boom, and the 8-ft. jib extension will handle 4000 lb.

Steel Clamp Fixture of Simple Design

The Cincinnati Tool Co., Cincinnati, Ohio, offers a new steel clamp fixture of simple design. The frame, slide, and screw of this clamp fixture are all of steel. The heat treated slide is of special



Steel clamp fixture made by the Cincinnati Tool Co.

design to prevent slipping under pressure. The fixture is said to be ideal for wood gluing and metal welding. It fits ½-in. pipe in any length so that a clamp of any size opening can be made.

Chemical Solves High Altitude Oil Problems

Development of a new organic compound which prevents dangerous thickening of aviation oils at sub-zero temperatures or excessive thinning in tropical heat is announced by the Rohm & Haas Company of Philadelphia, Pa. By combining this new material known as Acryloid HF with the selected oils a fluid condition is maintained in hydraulic systems in stratospheric and similar temperature extremes encountered in military operations.

With aircraft which climb from tropical temperatures to the stratosphere in a few minutes the material functions as the means of adjusting the oil to the rapid temperature changes. Other uses of the new "viscosity index improver" are on ships in northern waters, on vehicles for arctic regions, and in other low temperature operations.

The Rohm & Haas Company is issuing royalty-free licenses to oil companies enabling them to produce new types of hydraulic oils, hydraulic fluids and lubricating oils.

Hot-Press Phenolic Glue

Plaskon Division, Libbey-Owens-Ford Glass Co., Toledo, Ohio, has just brought out a new powdered resin glue, Plaskon 810-12. This hot-press phenolic glue is extensible with wheat flour and thus permits unusual economy while meeting strict performance standards in plywood and furniture panel stock.

Used without extension, the new glue is said to meet the most rigid requirements in water and weather resistance. Plywood made with it can be used under prolonged or constant extremes of temperature and humidity. The glue line is more resistant than the wood to the effects of fungi, acids, alkalis, oil, grease, fumes and aging.

At its maximum permissible extension with wheat flour—equal parts of resin and flour—the new resin assures a bond that will withstand a 3-hr boil test without delamination.

Method of Processing Synthetic Rubber

A Durez thermosetting phenolic resin formulated by Durez Plastics & Chemicals, Inc., North Tonawanda, N. Y., possesses the characteristic of softening synthetic rubber during the milling or processing of semi-hard and hard rubber compounds. Because of the peculiar stiffness of synthetic rubber as compared with that of natural rubber during such processing, it has been extremely difficult to add sufficient loading during milling to produce the semi-hard and hard rubber stocks. In the production of these stocks from natural rubber this loading with reinforcing materials such as carbon black was not a problem because of the natural plasticity of the rubber on the mill. The Durez resin, being thermosetting and completely compatible with the synthetic rubber, also reinforces the rubber in much the same manner as carbon black. Depending entirely upon the amount of resin used, the amount of reinforcing agents normally required to give a definite hardness can either be entirely eliminated or reduced proportionately.

Goodrich to Handle Lonn Blow Guns

The B. F. Goodrich Company is adding to its line of industrial hose a complete series of Lonn blow guns, whose fingertip-control is made possible by the use of rubber. The company will handle exclusively, through distributor channels, nation-wide sales of these valves made by the Lonn Manufacturing Company, Indianapolis, Indiana.

Lonn blow guns, known as Air Savers, Water Savers and spray guns are offered in several styles with various degrees of flow or restricted flow.

The Lonn valve features an internal trigger principle and involves only three working parts. It is opened and closed by flexing the rubber nozzle or hose.

(Turn to page 67, please)

Check these Features of

VICKERS

Variable Delivery PISTON TYPE PUMPS

Among the features indicated below are many of the reasons for the high overall mechanical efficiency and the high volumetric efficiency of Vickers Variable Delivery Piston Type Pumps. Also, the inertia forces of the rotating parts are minimized . . . the cylinders are arranged axially permitting more compact design.

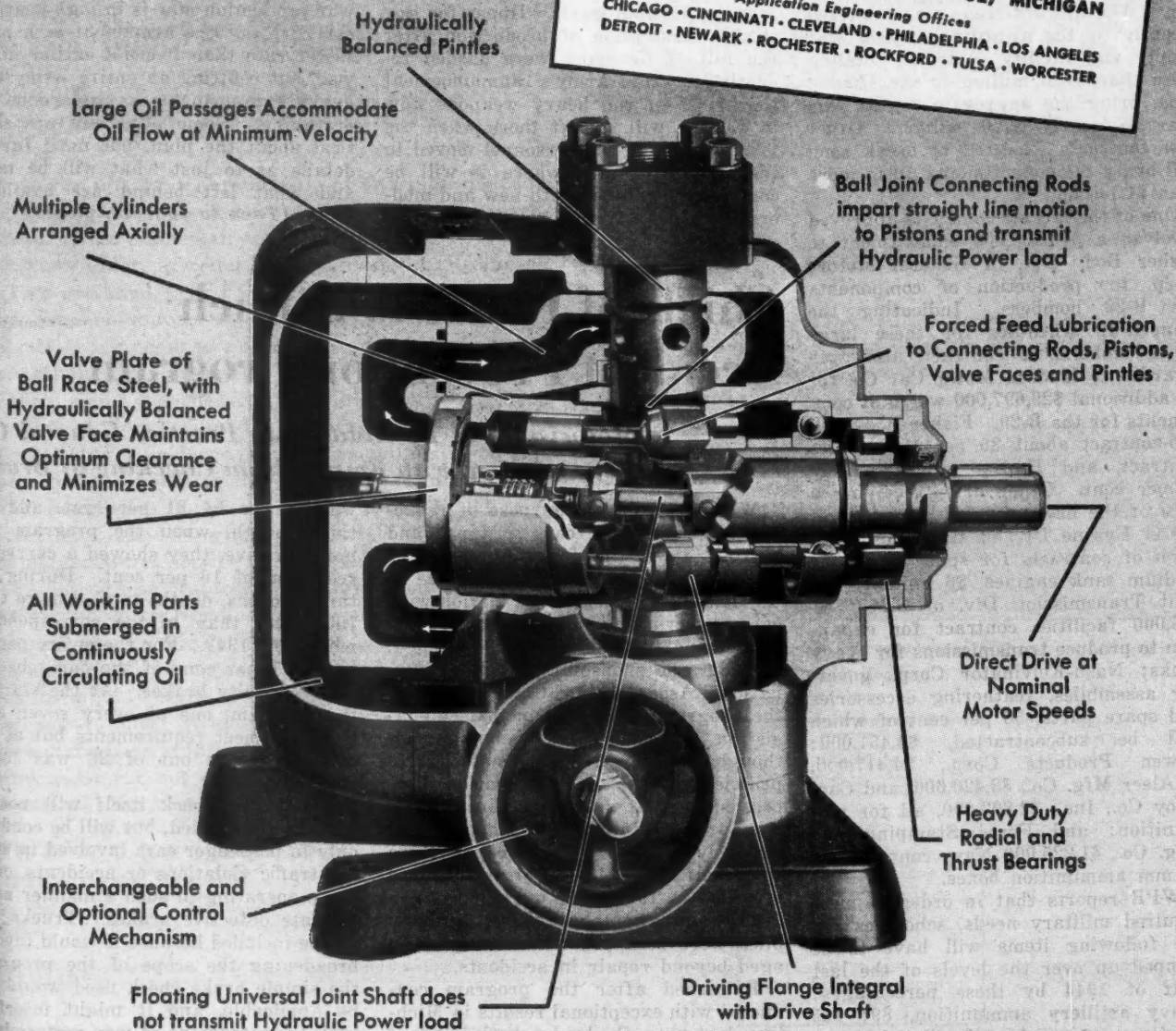
Write for new Bulletin 43-11 which includes description of construction, operation and types of controls, installation drawings, performance characteristics, installation and operating instructions of Vickers Variable Delivery Piston Type Pumps.

VICKERS Incorporated

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There Are More Than 5,000 Standardized VICKERS Units For Every Hydraulic Power and Control Function

Commitments Over \$1 Billion For Automotive Industries

Hopes for Automobile Production Cast into the Discard. All Out Effort to Speed Final Push

War production contracts continue to pour into the automotive and related industries plants at a rate which presages the biggest volume year in history. The upward trend was bolstered recently by the awarding of new war supply and facility contracts totaling more than \$136 million in the Detroit area, bring the aggregate so far this year to nearly \$750 million. Other new contracts expected to break soon will bring the commitments up to more than \$1 billion.

One of the largest contracts approved involved a \$79,235,000 commitment to Fisher Body Div. of General Motors Corp. for production of components for B-29 bombers. Indicating the stepped-up schedules for these large super-bombers, a contract also was awarded to Hudson Motor Car Co. for an additional \$29,697,000 worth of components for the B-29. Fisher Body will sub-contract about 30 per cent of its contract, and Hudson approximately 20 per cent. Other firms receiving a slice of the new program are: Detroit Diesel Engine Div. of G.M., continuation of contracts for spare parts for medium tank engines, \$6 million; Detroit Transmission Div. of G.M., \$5,025,000 facilities contract for expansion to produce transmissions for heavy tanks; Nash-Kelvinator Corp., governor assemblies, feathering accessories and spare parts, 36 per cent of which will be subcontracted, \$4,451,000; Bowen Products Corp., \$4,417,000, McAleer Mfg. Co., \$3,420,000, and Carboly Co., Inc., \$2,893,000, all for ammunition; and Ferro Stamping and Mfg. Co., \$1,225,000 Navy contract for 40 mm ammunition boxes.

WPB reports that in order to meet required military needs, schedules for the following items will have to be stepped up over the levels of the last half of 1944 by these percentages; heavy artillery ammunition, 89; 105 howitzer ammunition, 49; 60 and 81 mm mortar ammunition, 38; small arms ammunition, 50; heavy artillery and replacement components, 24; 60 and 81 mm mortars, 95; rocket program, 1000; Navy high capacity ammunition, 85; trucks (above 2½ tons) 12, and tanks, 19.

In view of these recent heavy com-

mitments and boosted schedules, there appears to be little encouragement for any optimistic thinking about resumed production of automobiles or other war casualty civilian goods. Hopes for any sizable resumption of production after the fall of Germany were dashed recently by the Army's announcement that most of the heavy weapons now in Europe will be left there when the job is done and the personnel moved to the Asiatic theater where it will be completely equipped with new and modern weapons. If this policy is carried

out, it will tax the capacity of American industry to do the job. When it is remembered that goods have been pouring into England and the Continent for four years to bring the armed forces there up to present strength, the size of the re-equipping job is staggering. The Army policy is predicated on the assumption that shipping capacity will be short and that the new equipment can be manufactured and sent direct to the Japanese front quicker than it could be moved. Admittedly, war production now is in high gear and can turn out the armament at a much faster rate than it could earlier in the war, but refitting an entire Army with heavy equipment is a stupendous undertaking. Some observers are skeptical about the plan, but until further details as to just what will be taken and what left behind are available, (Turn to page 48, please)

Chiefs of Police to Launch Accident Prevention Program

Motorists Will Be Induced to Practice General Car Conservation, with Emphasis on Checking of Brakes

With the two-fold purpose of reducing the number of cars scrapped and cutting down the loss of manpower through traffic accidents, the police of the nation will conduct a nation-wide car conservation and accident prevention campaign from April 15 to June 1.

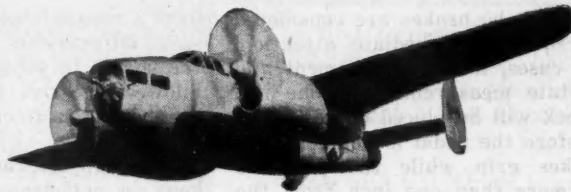
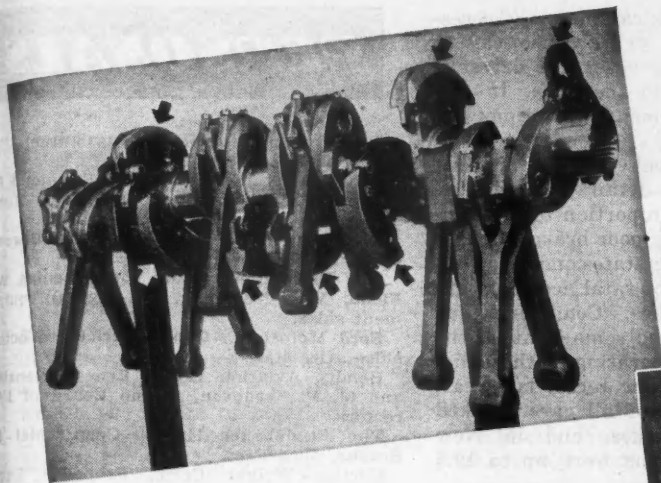
Under the sponsorship of the International Association of Chiefs of Police, the program will put principal emphasis on a brake check campaign, although it also will induce motorists to practice general car conservation. Records show that deaths and injuries to war workers in traffic accidents have seriously impeded the war effort. More than half the 824,000 persons injured or killed in 1943 were workers, and in 1944, approximately 250,000 automobiles were scrapped after being damaged beyond repair in accidents.

Patterned after the program conducted with exceptional results in Michigan last year, the brake check is timed to coincide with the usual spring increase in traffic accidents. Before the Michigan campaign started, accidents had been on the increase for seven consecutive months. Fatalities in the first month of the campaign were 33 per cent under the same month for the preceding year. In the second month, they

were fewer by 31 per cent, and the third month, when the program was not operative, they showed a carryover reduction of 16 per cent. During the three months, deaths totaled more than 100 fewer than in the corresponding months of 1943. For the entire period, about 11 per cent of the cars checked showed faulty brakes. At the start of the program, one of every seven cars failed to meet requirements but at the close only one out of 23 was found defective.

The brake check itself will not be universally applied, but will be confined only to passenger cars involved in moving traffic violations or accidents, or to those operating in such a manner as to indicate defective brakes. Trucks will not be included because it would involve broadening the scope of the program, the simple brake check used would not be applicable, and it might interfere with the movement of war materials.

The brake check will be a simple operation requiring only a minute to make. The inspecting officer will depress the brake pedal to the point where the brakes start to take hold. If he finds the clearance between the pedal at this point and the floor to be one (Turn to page 44, please)



Crankshaft of Ranger twelve-cylinder inverted V-type inline engine with connecting rods in place, showing (arrows) Needle Bearing equipped counter-balances.

Needle Bearings Carry Crankshaft Counter-Balance on Ranger Aircraft Engines

Here is an interesting application of Torrington Needle Bearings—a "cam-follower type" application—in the design of the crankshaft counter-balance of the Ranger twelve-cylinder, inverted V-type inline aircraft engine.

Two modified Type FT Needle Bearings are used to support each counter-weight, which in turn serves as a vibration dampener to provide dynamic balance on the crankshaft at high speeds.

Here again the characteristic advantages of Needle Bearing design are readily apparent: their high unit capacity due to the large number of small diameter rolls: their comparatively small O.D.; and the simplicity of their installation make them ideal for this and many other applications where dependability and long, maintenance-free service life are essential.

Perhaps these features will suggest an application where you can use Needle Bearings to improve efficiency, increase service life or effect cost economies through simplification of design or production steps.

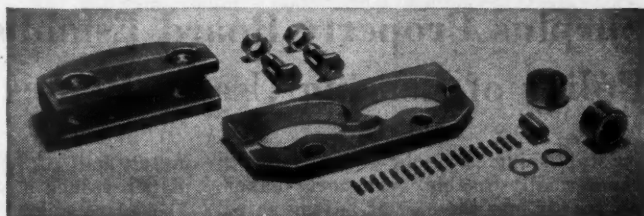
Remember—there's a type and size Torrington Needle Bearing to meet virtually every requirement. If you haven't the latest information on file for ready reference, send today for our combined catalog and application handbook, No. 30-A.

THE TORRINGTON COMPANY
TORRINGTON, CONN. • SOUTH BEND 21, IND.

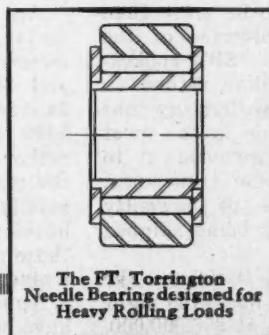
New York Boston Philadelphia Cleveland Detroit Seattle
Chicago San Francisco Los Angeles Toronto London, England



Dampener assembly. One bolt is secured through Torrington Needle Bearing, while second bearing is held in place for insertion of second bolt, completing assembly.

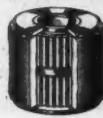
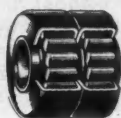
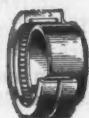


Dis-assembled view shows counter-weight parts, and detail of the modified Type FT Needle Bearing.



The FT Torrington Needle Bearing designed for Heavy Rolling Loads

TORRINGTON NEEDLE BEARINGS



inch or less, the brakes are considered faulty requiring immediate attention. In most cases, to avoid argument and to facilitate measurement, a one-inch wood block will be placed on the floor-board before the pedal is depressed. If the brakes grip while the pedal is slightly more than one inch from the floor, they are not considered safe and the driver will be urged to have them corrected.

Although this method of check might be considered arbitrary, it actually is grounded in sound engineering practice. It has been found that the average car requires about 130 pounds of pedal pressure for the maximum braking job. With one inch of pedal clearance it is possible to build up only about 50 pounds of pedal pressure, or slightly more than one third that of maximum braking power. At this pressure, a car going 20 mph would require 60 ft of travel to come to a stop, twice the distance allowed by most state laws. It is emphasized that the one-inch brake check is not a test, since it does not test the brakes, but rather, is a sound enforcement device to detect inadequate brakes. The campaign also will urge motorists to keep windshield wipers, tires, steering gear, and other parts having to do with safe driving, in good condition.

Drivers of cars found to have defective brakes will be subject to the particular enforcement measures in effect locally. In some cases, this entails leaving the car at the point of the check

until a repair truck can make the necessary adjustments or tow the car to the shop. In other cases, the driver is allowed to drive to the shop. In any event local enforcement regulations will prevail.

Although accident records are not kept in sufficient detail to determine accurately what proportion of all accidents are caused by poor brakes, figures compiled by twelve states indicate that about 11 per cent of fatal accidents are caused by bad brakes. Compulsory car inspections also shed some light on the number of cars operating with inadequate brakes. In New Jersey last year, about 15 per cent of all cars checked showed faulty brakes, and in New Hampshire, rejections were up to 19.5 per cent.

According to present plans the program will be launched by a nationwide radio hookup and a concerted publicity blast through newspapers and magazines with national circulation. In addition to the police organization, nearly 100 other groups will get behind the drive. Included among these are ODT, OWI, U. S. Army Service Forces, American Assn. of Motor Vehicle Administrators, American Automobile Assn., Automotive Safety Foundation, and other national organizations interested in safety.

Posters carrying the slogan "You're Only a Foot From Trouble—Check Your Brakes," and descriptive literature will be distributed by the various organizations cooperating in the drive.

Surplus Property Board Establishes Policy of Leasing Usable Planes

Establishing a policy for leasing commercially usable transport planes to save airlines the cost of buying ships which will be soon obsolete, the Surplus Property Board has allocated 127 out of 185 medium transports declared surplus to commercial airlines. The value of these ships is said to be more than \$47,000,000, but no deliveries of the planes have been made. SPB spokesmen admit that the dollar return on leasing ships may be low, but say that the Board feels that this is the most expedient way for the government to get its money out of the transports. Considerable quantities of urgently needed munitions are now being shipped by air.

The DPC Aircraft Division, the actual disposal agency, has 1760 light transport planes, valued at \$56,000,000. Of this number, 38 have been sold at a price of \$370,000. About 1500 of these are Cessna NC-78's which SPB says have no commercial use as yet because they are not licensable as it has not been proved that they are safe for civilian purposes.

The government has realized only \$1,135,000 out of the sale of approxi-

mately half of 3000 light reconnaissance planes valued at \$17,500,000 originally. These are among the most easily sold of all planes declared surplus, as they are the type of plane most frequently sold during peacetime for sportsman flying.

An odd fact about surplus planes declarations has come to light. In December, 6700 planes were produced and 3862 were declared surplus. In January, 6500 planes were made and 3000 were declared surplus. It is a rather poor comparison though, because the planes made in current months are mostly heavy bombers and other heavier types of military ships while those declared surplus are mostly light trainers.

Approximately 19,915 military planes have been declared surplus, the original cost of which was more than \$694,000,000. These are broken down into 2915 combat ships valued at \$322,000,000 and about 17,000 trainers valued at \$372,000,000. Only two of the combat ships have been sold by DPC and these went for \$25,700. Five hundred and forty-six of the trainers were sold for \$725,000.

PERSONALS

Recent appointments among automotive and aviation manufacturers:

Johns-Manville Sales Corp., Raymond P. Townsend, Vice-Pres. and Gen. Sales Mgr., Transportation and Automotive Dept.

Wilkening Mfg. Co., Helmuth G. Braendel, Chief Engineer.

The Electric Auto-Lite Co., Thomas W. Flood, Vice-Pres. chg. of original equipment sales.

Ford Motor Co., Don Wattrick, to home office sales staff.

Bendix Aviation Corp., Ernest Kanzler and M. P. Ferguson, to the Board of Directors.

The Studebaker Export Corp., Mel S. Brooks, Vice-Pres.

Curtiss-Wright Corp., Propeller Div., James Thomson to Military Programs staff.

The Timken-Detroit Axle Co., Gen. Service Div., Fred W. Parker, Jr., Director of Service, O. E. Johnson, Field Sales Mgr., Daniel Cellucci, Field Service Supervisor.

Ryan Aeronautical Co., B. A. Gillies, asst. to the President and Director of Flight and Service.

Willis-Overland Motors, Inc., William Howlett, special assistant in charge of public relations.

A. Schrader's Son, Div. Scovill Mfg. Co., Inc., A. R. Baldwin, Asst. Mgr. of Accessories Sales, E. H. McClure, agricultural market sales.

Allison Div., G. M. Corp., Engineering Dept., Roy Emerson Lynch, Executive Engineer, Charles James McDowell, Chief Development Engineer, J. C. Feters, Chief Turbine Engineer and Dimitrius Gerdan, Chief Engine Engineer.

Chevrolet Motor Div. G. M. Corp., Wendell G. Lewellen, in charge of parts and accessory merchandising. Herman C. King, Frank X. Veit, Daniel W. Fegert and R. F. Giddey, to commercial vehicle and truck sales dept.

Sperry Gyroscope Co., L. V. Bedell, manager of electronics plant, Garden City, L. I. Sealed Power Corp., Harry Hodge, Controller.

Tyson Bearing Corp., Harry L. Vines, Director of Sales, George C. McMullen, Asst. to President and Vice-Pres. in Charge of Product Research and Development.

Electrol, Inc., Ben Ashton, president. Perfect Circle Co., Duke Golden to Sales Div.

Turco Products, Inc., Donald S. Sprague, head of Aviation Dept.

The B. F. Goodrich Co., William E. Ireland, manager of passenger car tire and tube sales, Tire Replacement Div.

Stewart-Warner Corp., Norman J. Cooper, service manager, electrical products div.

Gold Medal Awarded To W. E. Holler

The Army Ordnance Association Gold Medal "For Outstanding Service" in the cause of National Defense has been awarded to W. E. Holler, Chevrolet's general sales manager. Mr. Holler organized and directed a nation-wide campaign through the Chevrolet Sales and Dealer Organization that increased the membership of the Army Ordnance Association by 7,590 members.

Mr. Holler received his citation from Brigadier General Benedict Crowell, president of the Army Ordnance Association and expert consultant to the Secretary of War at Washington.

The CONE AUTOMATIC MACHINE COMPANY

sees many

GOOD THINGS AHEAD



It is reported that

Helicopters capable of lifting as much as 15 tons and of carrying 35 or 40 persons, plus mail and baggage, are believed by one expert to be within the realm of possibility. *Col. H. F. Gregory, Engineering Division, Materiel Command, U.S.A.*

get ready with CONE for tomorrow

A pilot flying between South America and Africa recently flew across the Atlantic four times in three days. *Office of War Information.*

get ready with CONE for tomorrow

One of the country's leading department stores has scheduled a Postwar Fair for next May. Manufacturers are invited to participate, but space is not for sale. *R. H. Macy, New York City.*

get ready with CONE for tomorrow

Salvage apparatus for extremely great ocean depths has been patented. Its powerful jaws are guided by television apparatus. *Patent 2,355,086.*

get ready with CONE for tomorrow

Because of the high cost of converting ordinary electric power into high-frequency power, it is not at present believed that electronic cooking is practical for household use, although in commercial food processing it has great possibilities. Typical of its application to food processing is the recent experiment with packaged pancake flour in which the temperature inside the package was raised to 130 degrees in less than 30 seconds, completely destroying all insect life. *Scientific American.*

get ready with CONE for tomorrow

Rubber scientists think that they have solved the problem of ice on airplane propellers by the use of a three-ply rubber covering, the center layer of which is an electric heating element. *Goodyear Tire & Rubber Co.*

get ready with CONE for tomorrow

An inter-continental highway between Alaska and Siberia, by way of a tunnel under Bering Strait, is being seriously considered. *Alaska Highway Committee of Pacific Northwest Trade Association.*

Experiments are being made with plastic bottles blown in the same molds used for glass. *Advertising & Selling.*

get ready with CONE for tomorrow

A total of 29 dams is planned for the Pacific Northwest, the first six of which will cost 226 million dollars and provide power and water for a population of 2 million. *Engineering & Mining Journal.*

get ready with CONE for tomorrow

A new method of dyeing acetate rayon is said to make the colors practically fade-proof. *North Carolina Fabrics Corporation.*

get ready with CONE for tomorrow

A large airplane manufacturer has produced an experimental model of a 200 pound automobile. *Science Digest.*

The first commercial model of a sound-on-tape machine has been made and is said to play continuously for eight hours. *Fonda Corporation.*

get ready with CONE for tomorrow

The use of music in factories is expected to create jobs for 26,000 musically trained broadcast directors. *Science News Letter.*

get ready with CONE for tomorrow

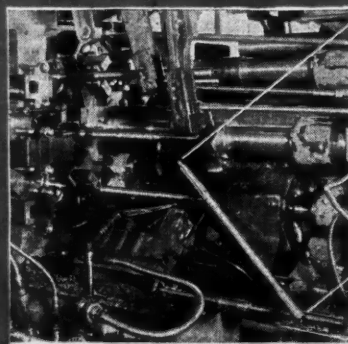
A new device that opens and closes a window thermostatically is waiting for release of materials to go into production. *E. O. Gillen, 1713 N. Water St., Milwaukee.*

get ready with CONE for tomorrow

A new eight-engined flying freight boat with 320 foot wing span is expected to be ready about the first of the year. *Howard Hughes, Aviation News.*

get ready with CONE for tomorrow

A new ingredient added to the Army's soap is said to make it work effectively in any sort of water, salt, fresh, cold, hot, soft, or hard. *E. I. duPont de Nemours & Co. Inc.*



...and remarkable things are being done NOW

Turning a shaft of this length was considered impractical for a multiple spindle automatic lathe — until it was produced on an 8-spindle Conomatic in the unusually fast time of 63 seconds. Such speed, plus high precision, has given us the best equipped armies in the world and will, when the war is won, make our manufacturers the most productive in the world.

CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U. S. A.

15



AWARDS

Names of winners of Army-Navy "E" awards in or allied with the automotive and aviation industries announced since the Feb. 1 issue of *AUTOMOTIVE and AVIATION INDUSTRIES* went to press:

BENDIX AVIATION CORP., Pacific Division, North Hollywood, Cal.
BUCKEYE TOOL CORP., Dayton, Ohio.
CHANDLER - EVANS CORP., Dayton Plant, Dayton, Ohio.
DIECASTERS, INC., Ridgefield, N. J.
GARWOOD INDUSTRIES, INC., Boat Division, Marysville, Mich.
LELAND ELECTRIC CO., North Main Street Plant and Webster Street Plant, Dayton, Ohio.
MASTER TIRE & RUBBER CORP., Findlay, Ohio.
PICK MANUFACTURING CO., Plants I and II, West Bend, Wis.
SLAYMAKER LOCK CO., Lancaster, Pa.
SURFACE COMBUSTION CO., Toledo Plant, Toledo, Ohio.
STOLPER STEEL PRODUCTS CORP., Milwaukee, Wis.
UNITED STATES RUBBER CO., Winnsboro Mills, Winnsboro, S. C.

★ "E" Star Awards ★

for continuous meritorious services on the production front have been awarded to the following firms:

FORMICA INSULATION CO., Cincinnati, Ohio.
GREENFIELD TAP AND DIE CORP., Greenfield, Mass.
LINCOLN ENGINEERING CO., St. Louis, Mo.
PRATT & WHITNEY, Division Niles-Bement-Pond Co., West Hartford, Conn.
RESISTOFLEX CORPORATION, Belleville, N. J.
WILLARD STORAGE BATTERY CO., Cleveland, Ohio.

Ford Building New Type Liberator Bomber

The Ford Motor Company is producing a new-type Liberator bomber at Willow Run, an improved version of the four-engined B-24 which has innovations including a single vertical tail fin.

As production increases on these new planes, the familiar twin-tailed B-24s will be replaced by the new ships, details of which remain secret at present.

The War Production Board recently announced award of a contract for \$298,844,000 worth of aircraft from Ford at Willow Run, much of which it is understood will be in the form of the newly modified bombers.

Bus Production Quotas Reduced

Quotas for the manufacture of integral buses during 1945 were set at a meeting of the Bus Manufacturers Industry Advisory Committee, according to a report of the Detroit Regional WPB Office.

The new quotas provide for produc-

tion of 9,413 integral buses during 1945, a reduction of 979 buses from the earlier production program of 10,392 approved by WPB. The reduction, which will occur in the last six months of 1945, was determined by the WPB requirements committee, officials of the transportation equipment division told the committee members.

Albert S. Bonner

Albert Sidney Bonner, 53, president of the Clark Equipment Co., Buchanan, Mich., died at his home in Buchanan Feb. 8.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE AND AVIATION INDUSTRIES

Moderately reduced levels of business activity are indicated. The *New York Times* index for the week ended Feb. 3 stands at 142.4, as against 146.1 for the preceding week and 149.3 a year ago.

Department store sales, as reported by the Federal Reserve Board, advanced slightly, from 161 to 163 per cent of the 1935-39 average, during the week ended Feb. 3. The indicated total is 11 per cent above that for the corresponding period a year earlier, as against a preceding similar excess of 17 per cent.

Railway freight loadings in the same period totaled 738,680 cars, 2.7 per cent below the figure for the week before and 8.3 per cent less than the corresponding number last year.

Electric power production during the week ended Feb. 3 registered a further decline and was only 0.3 per cent above the corresponding level in 1944, as compared with a like gain of 1.2 per cent shown a week earlier.

Crude oil production in the week ended Feb. 10 averaged 4,728,800 barrels daily, 4700 barrels above the figure for the preceding week and 329,650 barrels more than the comparable output in 1944; but it was 28,000 barrels below the average recommended by the Petroleum Administration for War.

Production of soft coal during the week ended Feb. 3 is estimated at 11,360,000 net tons, 2.7 per cent below the output in the week before. Production thus far in 1945 is 10.6 per cent less than the corresponding amount last year.

Engineering construction contracts awarded during the week ended Feb. 15, according to *Engineering News-Record*, totaled \$43,908,000, more than double the preceding weekly figure and 18 per cent above the corresponding sum in 1944. Awards for private construction are 26 per cent greater than the comparable amount last year, and contracts for public work show a similar gain of 17 per cent.

The Irving Fisher index of wholesale commodity prices on Feb. 9 stood at an all-time peak, 114.46 per cent of the 1926 average, as against 114.30 a week earlier and 112.55 a year ago.

Member bank reserve balances increased \$66,000,000 during the week ended Feb. 7, but excess reserves were reduced by \$100,000,000 to an estimated total of \$900,000,000. Aggregate loans and investments of reporting members declined \$239,000,000 in the same period, with commercial, industrial and agricultural loans showing a recession of \$4,000,000, to a total of \$6,846,000,000.

PUBLICATIONS

Bulletin No. 239 has been issued by Aircraft Screw Products Co. It describes and illustrates the Heli-Coil screw thread inserts and Aero-Thread screw thread system. A page is also devoted to the installation of these inserts.*

The Bullard Co. has published a Man-Au-Trol Primer, which gives an introductory description of the Bullard Man-Au-Trol Vertical Turret Lathe. Performance data is given, engineering-application, etc.*

Michigan Tool Co. has issued bulletin No. 1843 describing its new Shear-Speed Gear Cutting Machine, designed for rough and semi-finish cutting gears up to 4 in. diameter and 2 in. face width. Specifications for Model 1843, together with illustrations of the Shear-Speed machine and types of gears handled, are included in the bulletin.*

The current issue of Bakelite Review contains an interesting article on Bodley By Bonding, a picture story, showing how U.S. truck bodies are fabricated from wood parts bonded with Bakelite resins.*

American Foundry Equipment Co. has issued Bulletin No. 19, describing the American Tabl-Spray Metal Washing Machine. This is a revised edition which includes new developments in the equipment. Operating sequences, mechanical features, construction specifications and details are fully covered. Schematic drawings and diagrams are included illustrating spray cleaning action on parts to be cleaned. Briefly described is the extensive metal cleaning laboratory of the company.*

Pesco Products Co. div. of Borg-Warner, has issued a new folder, The New Univas Aircraft Brake Intensifier. A description of the brake intensifier is included, together with installation diagrams and operating data.*

E. I. duPont de Nemours & Co., Fabrikold Div., has issued five circulars on Fairprene Cement, an industrial adhesive made from synthetic elastic compositions. The circulars variously describe the different types of Fairprene, give specifications, uses, etc.*

The Automatic Transportation Co., Div. of The Yale and Towne Mfg. Co., has prepared its 1945 series of materials handling bulletins, Numbers 1 to 10. Each bulletin consists of four to six pages of pictures and text dealing with actual operating methods and is based on plant interviews and the study of methods. The bulletins are put together in one folder for easy reference.*

The Safety and Health Section of the U. S. Dept. of Labor has published, in booklet form, a series of charts entitled Work Safely—Avoid Personal Injury. These charts will be issued monthly and are available through the U. S. Government Printing Office at 5 cents each.

Lear, Inc. has issued a new booklet, Lear Know-How, describing and illustrating its various products, production facilities, etc.*

The Chain Belt Co. has announced the publication of a new catalog on Rex Table Top chain belts. It describes and illustrates the chain and its design features in detail and shows applications in bottling, labeling, sealing, capping and other package or small part handling processes.*

A new edition of Designing For Die Casting has been issued by The New Jersey Zinc Co. It contains much new information assembled during the five years since the original booklet was published. Its purpose is to help users of die castings arrive at designs which take full advantage of the possibilities of the die casting process and avoid its limitations.*

* Obtainable by subscribers within the United States through Editorial Dept., AUTOMOTIVE and AVIATION INDUSTRIES. In making requests for any of these publications, be sure to give date of the issue in which the announcement appeared, your name and address, company connection and title.

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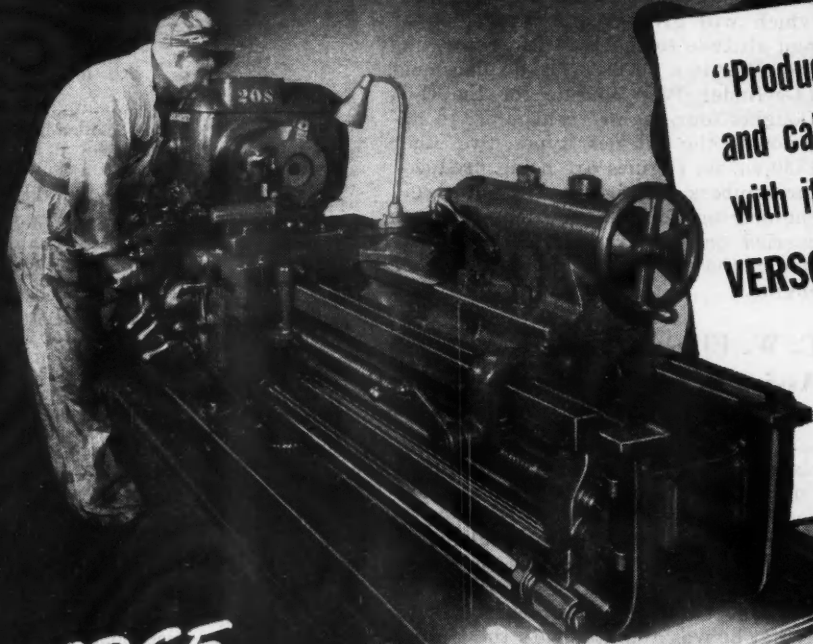
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"Producing work of high quality
and caliber...we are well pleased
with its performance."

VERSON ALLSTEEL PRESS CO.
CHICAGO, ILLINOIS

Because Verson Presses and Brakes are custom-made, lathe work varies widely in size and physical properties. Verson finds their new Lodge & Shipley 20" Engine Lathes highly adaptable, easily operated—and because all moving parts are fully enclosed, a very safe lathe to handle.

**LODGE
& SHIPLEY
LATHES at work**

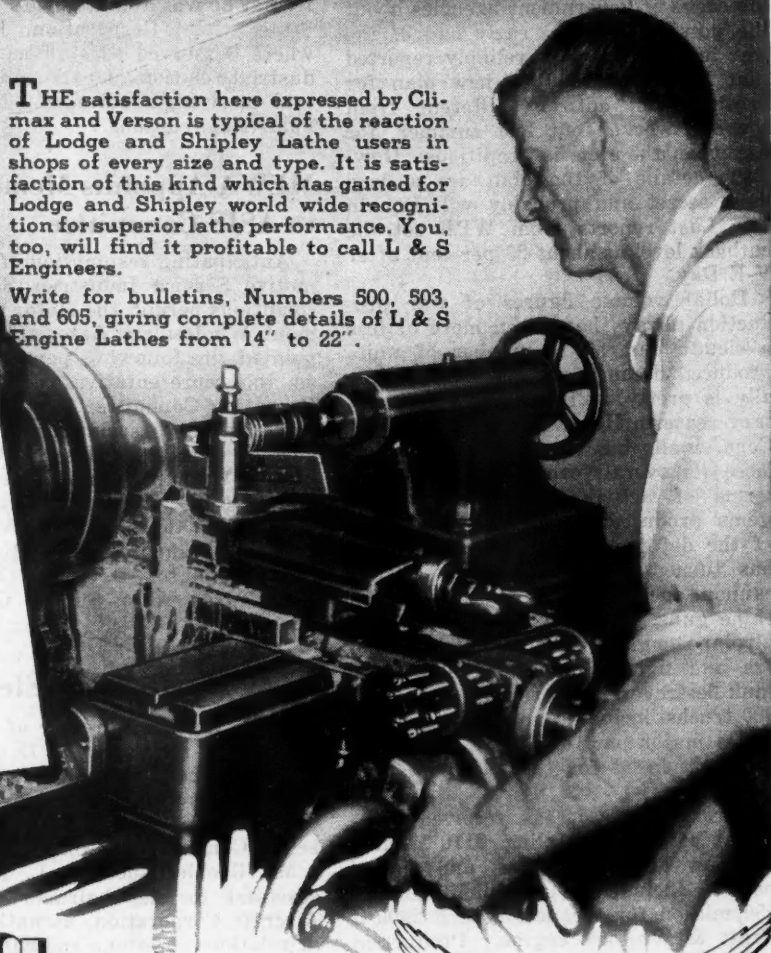
"Doing a variety of turning
and threading jobs...these
lathes are favorites of our
operators."

CLIMAX ENGINEERING CO.
CLINTON, IOWA

Running two busy shifts per day, Lodge and Shipley 14" Engine Lathes turn tank shafts, also various parts for the well-known Climax Gas and Diesel Engines and Generating Sets.

THE satisfaction here expressed by Climax and Verson is typical of the reaction of Lodge and Shipley Lathe users in shops of every size and type. It is satisfaction of this kind which has gained for Lodge and Shipley world wide recognition for superior lathe performance. You, too, will find it profitable to call L & S Engineers.

Write for bulletins, Numbers 500, 503, and 605, giving complete details of L & S Engine Lathes from 14" to 22".



THE LODGE & SHIPLEY MACHINE TOOL CO.

CINCINNATI 25, OHIO, U. S. A.

ENGINE—TOOL ROOM—AUTOMATIC—OIL COUNTRY LATHES



Commitments for Automotive Industries

(Continued from page 42)

there will be no definite basis for judging its practicability.

Although there is no public talk about it, there is considerable speculation about WPB's plans for cutbacks either shortly after V-E day or some time in the indefinite future thereafter. Some observers profess to see in the recent government announcement that no new cars would be made this year a definite program of continued all-out war production after Germany's defeat. Others say that this is not necessarily so, that government is talking a good game to back up its present drive for more production, manpower legislation, and other measures calculated to hammer home the urgency and toughness of the war. Meanwhile, WPB says nothing. However, reports seep out of Washington that there is considerable sub rosa optimism seeping out around the edges of government agencies about the possibility of an early end of the war in Europe. It is reliably reported that WPB has ready a new plan for reconversion, entirely different from the one worked out last summer, for use when the time is propitious. However, details of the plan are a deep dark secret and probably will remain so. Last reports from WPB set the cutback level at about 23 per cent after V-E Day.

Dollar volume figures of war production always have been more or less a cloudy clue as to number of units produced because cost per item generally is pretty well restricted for military reasons. However, General Motors Corp. finally has succeeded in breaking loose its overall production figures in terms of actual number of various items produced. Since the beginning of the defense program in 1940, G.M. has turned out "more than" 180,000 cannon, one million .30 and .50 cal machine guns, 2,400,000 carbines, 180,000 airplane engines, 9000 complete bombers and fighter planes, 31,000 tanks, tank destroyers and armored cars, 740,000 trucks, including amphibious ducks, and a major part of all the Diesel engines produced for the U. S. on land and sea.

Ford Motor Co. has received additional contracts totaling \$110 million for new aircraft engines and engine parts. Included is a commitment of \$50 million for the new type R-2800-C Pratt & Whitney engine. Production will begin as soon as an additional order for \$35 million worth of the B type can be completed some time next summer. When production of the new engine begins, more and larger contracts are expected. In addition to the new engine contracts, Ford has received orders for parts totaling about \$25 million.

Buick Div. of G.M. now is in pro-

duction on two new types of aircraft engine. One is a 14-cylinder, 1830 cu. in. displacement P&W Twin Wasp which will give greater range, speed, and altitude to the B-24 Liberator, and the other is a 2000 cu. in. displacement 14-cylinder P&W engine for the C-54 Douglas four-engine transport. In addition to the two new types, two other 1830 cu. in. engines are being produced for bombers and fighters. Tooling and engineering for the new engines was carried on concurrently with production of the company's Liberator bomber engine.

C. W. Eliason Named Assistant to Geo. Romney

Appointment of Courtleigh W. Eliason as assistant to George Romney, managing director of the Automotive Council for War Production was announced by Mr. Romney.

Mr. Eliason has been regional industrial adviser, United States Maritime Commission, Oakland, California, for the past two-and-a-half years. Prior to that he was affiliated with the United States Steel Corporation, Pittsburgh, where he served as staff assistant, industrial relations department, and general assistant, office of director of industrial relations.

MEWA Appoints Members to ASIS Committee

Anticipating resumption of the Automotive Service Industries Show when conditions permit, the Motor and Equipment Wholesalers Association has appointed the following persons to serve as its representatives on the Joint Operating Committee that acts for the participating associations in the conduct of the show: Messrs. W. F. Wilkerson, Wyoming Automotive Co., Casper, Wyo.; G. E. Johnson, Auto Spring & Bearing Co., Roanoke, Va.; F. G. Stewart, Standard Automotive Supply Co., Washington, D. C., and C. E. Owen, East Texas Auto Supply Co., Tyler, Texas.

A. M. Rochlen Elected

A. M. Rochlen, director of industrial and public relations for Douglas Aircraft, has been elected national chairman of the Public Relations Advisory Committee of the Aeronautical Chamber of Commerce of America.

Mr. Rochlen succeeds L. D. Lyman, assistant to the chairman of United Aircraft Corporation, as national public relations chairman and will serve for the next six months. John E. Canaday, public relations manager for Lockheed Aircraft Corporation and chairman of the Western Regional Public Relations Committee, and J. W. Sweetser, public relations director for Curtiss-Wright and chairman of the Eastern Regional Public Relations Committee, will serve as vice chairman of the National Committee.

BOOKS

The unusual economic and operating characteristics of the contract tool and die industry which have set it apart from all others in reacting to business cycles, are analyzed for the first time in a study, "THE TOOL AND DIE INDUSTRY COMES OF AGE," published by the National Tool and Die Manufacturers Association of Cleveland and the Chicago Tool and Die Institute. It provides this expanded industry of 5000 shops with the background material and statistics necessary for a thorough analysis of operations and recommendations for helping them face post-war problems.

The study points out that one of the great needs of the industry is a leveling off of the sudden rises and sharp falls. A method suggested is through the development of more diversified customers whose peak needs would be spread across the months of the year, or the years of business cycles. The study also emphasizes that the 1936-39 index period normally used by the government in determining the normal profits upon which it bases excess profits, places the tool and die industry in a difficult financial position to avoid expected post-war recessions. Nor can the invested capital principle to used since labor is the dominant cost factor and goodwill and engineering ability the primary sales factors.

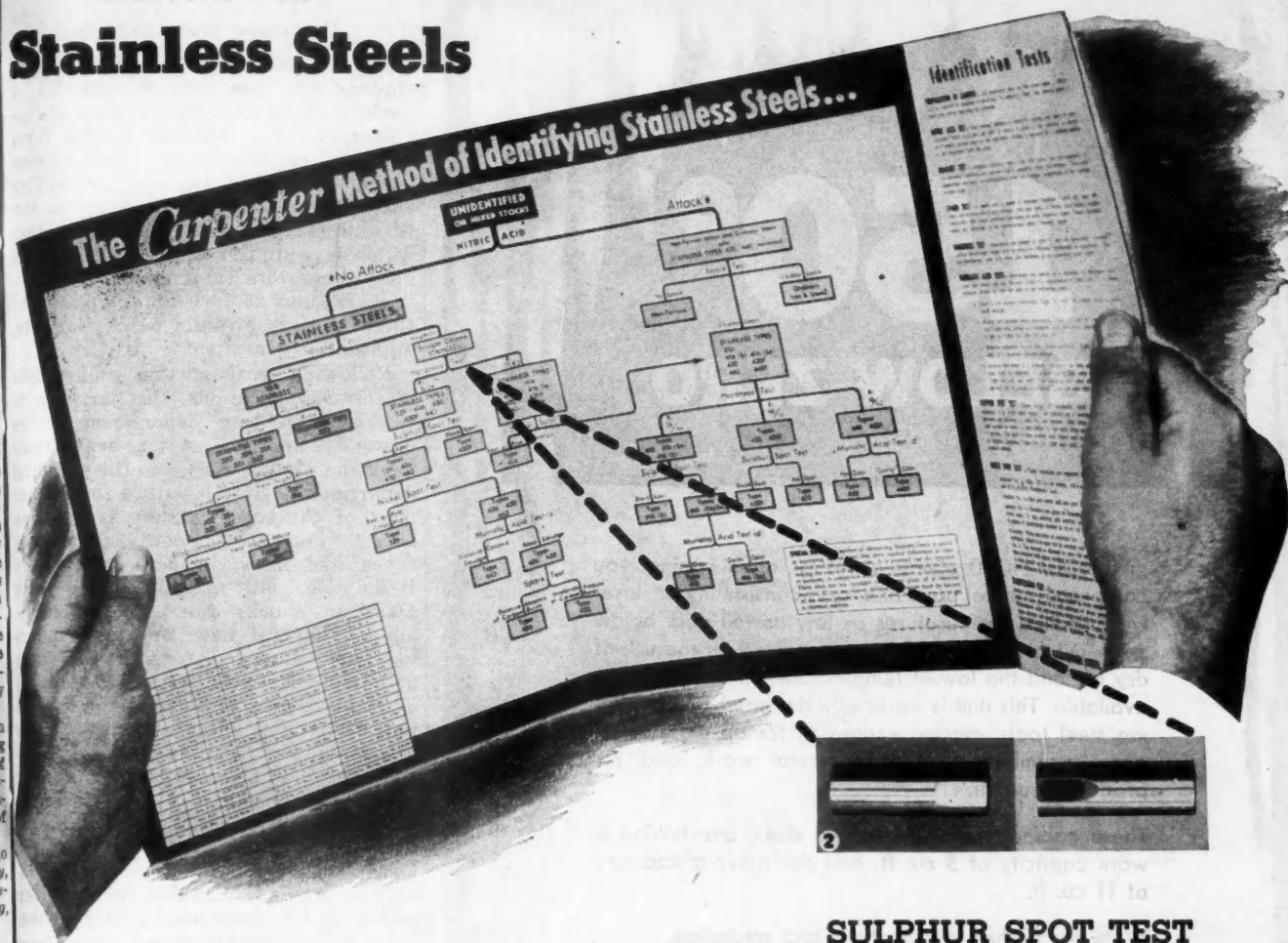
Much of the material will be valuable in supplying information required when filing applications for relief under Section 722 of the Excess Profits Tax Law. The contents of the study include "Financial Condition of the Industry," "Peculiarities of the Industry" and "Postwar Outlook."

Copies may be purchased by writing to George S. Eaton, Executive Secretary, National Tool and Die Manufacturers Association, 1412 Union Commerce Building, Cleveland 14, Ohio.

ANALYSIS OF DRILL-JIG DESIGN, by J. I. Karash. Pub. McGraw-Hill Book Co. 353pp. In presenting this text on the design of drill jigs, the author has taken a novel approach to the problem by stressing the mental process involved in tool designing. It is assumed that the tool designer understands the production process and is capable of translating his ideas into design details. The text places emphasis upon the thinking process which must precede the preparation of the working drawing of a given drill jig. Basically the thinking process is divided into four major steps: division of work decisions, machine decisions, tool decisions, and justification for action. Separate chapters are devoted to each of these elements, with supplementary discussion of such details as secondary-operation jigs, positioning features, chip control, and principles of interchangeability of jigs. This book should prove to be a valuable contribution to production lore and of interest to engineers and tool designers.

SAMPLING INSPECTION TABLES by Harold F. Dodge and Harry G. Romig. Pub. John Wiley & Sons, Inc. In the preparation of this handy reference on sampling inspection tables for single and double-sampling procedures, the authors have drawn upon the practical experience in quality control developed over a long period of years in the Western Electric plants. The material should prove to be a time-saver to engineers and statisticians and is well adapted for use in courses on quality control. The tables and charts are said to meet the needs of all manufacturing organizations since they apply to manufactured lots either large or small. The text provides procedures for setting up sampling inspection programs with recommendations for recording and summarizing essential data.

To Help You Identify Stainless Steels



SULPHUR SPOT TEST

This is one of the 11 tests used in the "Carpenter Method of Identifying Stainless Steels".

Place three drops of Sulphuric Acid solution (one part Sulphuric Acid, three parts water) on a newly-ground spot of the specimen and allow to react for one minute. One drop of a 5% solution of Lead Acetate in water is then added to the acid drop and allowed to react for 15 seconds. The spot is then washed with water and examined. A positive test for Sulphur (Stainless Types 416 (S), 420F and 430F) is the presence of a black sulphide deposit.

YOU know the troubles a mix-up in Stainless stock can cause in heat treating, machining, stamping, welding or other fabricating operations. So it's important to you to have a quick method for identifying Stainless that may become mixed in stock.

The Carpenter Laboratories have developed a new and simplified chart for identifying various types of Stainless Steel. The Chart diagrams and explains the nitric acid test, magnet, spark, hardness, and muriatic acid tests, sulphur spot and nickel spot tests, and the stabilization test, and shows when and how to use each one. With this chart you can check the identity of Stainless Steels which may be in question.

Use it in your laboratory, to help your stockroom, warehouse or production department check on mixed stocks. To obtain a copy, simply fill out the coupon.

THE CARPENTER STEEL COMPANY

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Carpenter STAINLESS STEELS

150° BELOW ZERO

In a KOLD-HOLD electrical refrigeration cabinet you can process metal parts and tools consistently at closely controlled temperatures as low as 150 deg. below zero—much lower than can be attained by the use of dry ice and the lowest temperature yet commercially available. This unit is especially designed for hardening steel tools, making expansion fits on close tolerance assemblies, for experimental work, and for product research.

These cabinets are built in two sizes, one having a work capacity of 5 cu. ft. and the other a capacity of 11 cu. ft.

Write for further specifications and quotation.

KOLD-HOLD MANUFACTURING COMPANY
453 NORTH GRAND AVE. • LANSING 4, MICH.



KOLD-HOLD

Gear Production at Fairfield

(Continued from page 26)

models of this versatile equipment, including the type No. 6 and No. 7 models. Here are handled the parts requiring internal splines, special form cutting, cluster gears, herringbone gears, internal gears, etc. Rounding out the gear cutting facilities is the Gleason straight bevel gear department which is equipped with Gleason bevel gear generators ranging in capacity—3, 8, 12, and 25 in. This handles the full variety of straight bevel gear sets, differential gears, etc.

Following gear cutting and finish-machining operations, the parts go to the heat treating department to be described shortly. After heat treatment the work is routed to the grinding department. Here it will be found that most of the bore grinding is done on Heald internal grinders of various types and sizes, including the large Heald No. 172 machine fitted with Garrison chucks for grinding large gears. Several new Bryant grinders also are employed for internal bore grinding. External grinding of every description goes to batteries of Cincinnati Filmatic grinders and Norton plain grinders. The familiar Blanchard surface grinder fitted with a magnetic chuck forms a part of the grinding facilities. A Magnaflux machine is used for surface inspection of certain gears, where specified, in some instances both for checking in the green and after heat treatment and grinding.

In the rear of the plant, away from other activities, is a self-contained department for the complete machining of differential cases, and for differential assembly. The subdivision of work in this department is rather interesting. For example, inside boring, turning, facing, etc., is done on a battery of heavy-duty Potter & Johnston turret lathes; some external operations are handled on a battery of Fay automatics. Flange holes are drilled on Natco multiple-spindle drill presses. Of unusual interest is the method of drilling and reaming the spider holes in the differential case. For maximum flexibility, without affecting interchangeability at assembly, the spider holes are drilled as half-holes without matching in pairs for this operation. This is done in a simple double-end Garvin machine, using good, precision-made fixtures and tooling. The half-holes are finish-reamed to a tolerance of 0.0005 in., providing perfect interchangeability at final assembly.

Heart of the control exercised over gear cutting operations is a well equipped gear laboratory with the latest type of Illinois gear checking machines, including an involute checker, gear charter, normal pitch checker, and lead checker. Supplementing these is an Electrolimit gage and a Sheffield gage for holding fine tolerances on

(Turn to page 52, please)



The Strangers

It happened in France the other day. One of the bitterest ironies of our age of war . . . An American soldier—whose father had died in Flanders' fields without ever having seen his infant son — gave his life for the future of an infant son he in turn had never seen.

Three generations of strangers . . . and now what of the third generation? Will this child, too, grow up to inherit all the old lies, the mistakes, the weaknesses that go to make up war?

What is it that his father and his father's father died for?

Already, we're dusting off the solemn aphorisms about not having died in vain, and we'll build a bright new marble cenotaph to his unknown father. But it

isn't enough. Brother, it isn't enough!

We will emerge from this war the most powerful nation on earth. Our Navy and our Air Forces will be twice the size of all others combined — our manufacturing productivity will equal half the world's total capacity. If we can't enforce peace with that kind of club — and if we can't make jobs building houses for our sons to live in as well as by building tanks for them to die in — then God help us!

Today, the engineers of the basic machine tool producers stand ready to help the men of government and of industry to plan now for reconversion to a strong and prosperous America.

One of these is a Bryant man. We urge you to call him in today, for time is running out!



BRYANT CHUCKING GRINDER COMPANY

**SPRINGFIELD
VERMONT, U.S.A.**

bores and OD measurements. Laboratory equipment is in continuous use for the checking of all hobs and cutters. Sample gears from each initial setup are completely inspected and followed by a sampling check of gears during each production run. The equipment also is used in the development of new gears, in engineering research problems, as well as for trouble-shooting.

In the production department there is found a comprehensive Gleason gear testing department with the familiar equipment for testing, running-in, and lapping operations.

The heat treating department is completely isolated from the rest of the plant and is under constant super-

vision of the metallurgical laboratory. Specifications are provided for each run of each part, incorporating such changes in procedure as may be dictated by the material known to be in process at the time. Flexibility of the highest order dominates the activity in this area. A portion of the case-carburizing is handled in a battery of seven Surface Combustion batch type furnaces. Additional pack carburizing is done in a large Surface Combustion continuous two-row pusher furnace which is used for large runs. Gas carburizing is done in a Leeds & Northrup Homocarb where the ultimate in case depth control and characteristics is demanded.

Quenching takes three different forms, depending upon the nature of the work. Large gears and other gears sensitive to fire distortion are quenched in the familiar Gleason machines. Other parts are quenched in still tanks or in the large agitated solution tank.

In addition to these major items of equipment there is a battery of L & N Homo drawing furnaces. Annealing operations are of batch type. One of the finest pieces of equipment in this department is the Surface Combustion rotary hearth atmosphere controlled furnace for hardening. Its unusual feature is provision for two separate door openings, used selectively. One door is high but narrow for extremely long slender pieces; the other is wide and rather high to permit the entry of the large gears. At the time it was installed this furnace was said to have the largest door openings in use for a furnace of this type.

Activity of the heat treating department is in a constant state of flux and improvement owing to the progressive research program of the metallurgical laboratory. For example, at the present time a great deal of attention is being given to the utilization of the Jominy test for hardenability. Another stage in development is the introduction of shot-peening. One of the most interesting of the new techniques introduced recently is that of selective masking of critical sections to facilitate selective hardening of intricate parts. Conventional methods were discarded in favor of a technique in which a special wax dip is employed. Parts are installed in special fixtures and dipped in the wax tank either by hand or by rotating on a spindle. The wax is effective in stopping off the copper plate and is removed by immersion in hot water prior to carburizing.

Where forgings are employed, they are annealed in the heat treating department and shot-blasted in an American Wheelabrator Turnblast before being routed to the machine shop. Following finish machining the work is transported to heat treatment on a gravity roller conveyor which connects the machine shop section with the heat treating department. After quenching the work is degreased in a large Detrex degreasing tank, and is then grit-blasted in a Pangborn machine.

The foregoing is intended as a generalized treatment of this important gear plant. Considering the variety of the product that is about the only way in which a visualization is feasible. However, to show how specific parts are made we have reproduced the complete factory routings of a straight bevel gear and pinion. This will give the reader a better picture of how an individual part is processed. In addition, we have reproduced the routing of one of the differential cases as an example of an entirely different problem.

Finally the visualization of this operation is made more realistic by the comprehensive pictorial section, containing views selected from various interesting sections of the establishment.

IN THE "KEYMAN" SPOTS

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Where dependability is a "must," where you need strength and stamina and efficiency that can be taken for granted—in the KEY MAN spots, rely on Aetna Bearings. Built into them are the toughness and enduring efficiency that are marks of champions.

Today, as never before, industry is studying how wider use can be made of anti-friction bearings in the "key man" positions—not alone in designs of new products but to rejuvenate old ones.

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Are you grooming your products for the bitter competition of tomorrow? Talk to our engineers—they are helping the key men of many businesses.

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THERE MUST BE NO COMPROMISE WITH

Safety

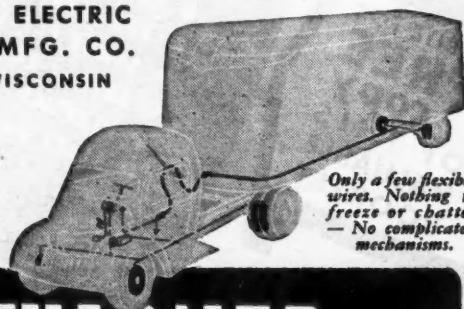
TODAY, America is depending on motor transportation as never before. Every load of war materials and equipment carried by big trailer outfits must get through — and *on time!* Delays due to accidents caused by ineffective brakes must be prevented — there should be no compromise with *safety!*

It is significant that 80% of all power-brake equipped trailing vehicles purchased by the government during this war — *have Warner Electric Brakes.* So take a tip from Uncle Sam — protect your drivers, your cargoes, and your trailer outfits — give them the **EXTRA SAFETY** of *Controlled Braking Power* — exclusive feature of Warner "Vari-Load" **ELECTRIC** Brakes. No matter what the weather, the driver can pre-set any and all brakes to fit **BOTH** load conditions and road conditions — thus keeping his train straightened out and under full control even

when the going is slippery, and avoiding costly tie-ups due to damaged equipment.

On all future trailer purchases, specify Warner "Vari-Load" *Electric Brakes* — world-famous for safety, simplicity, and dependable, efficient, trouble-free performance.

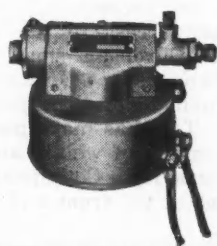
**WARNER ELECTRIC
BRAKE MFG. CO.
BELOIT, WISCONSIN**



*Only a few flexible
wires. Nothing to
freeze or chatter
— No complicated
mechanisms.*

WARNER

ELECTRIC BRAKES



NOW — Present Owners of Trailers with Warner Electric Brakes Can Have This New WARNER CONTROLLER

The new Warner Controller—simple and compact—synchronizes the hydraulic brakes on tractor with the Electric Brakes on trailer. The tractor's regular foot pedal operates both braking systems. This development creates smooth foot-touch tractor-trailer braking under all conditions—eases driving strain—assures greater safety. Controller is easily and quickly fitted into hydraulic brake line. See your Warner dealer about changing over your present equipment.

**FOOT PEDAL PRESSURE
CONTROLS BRAKES ON
BOTH TRACTOR AND
TRAILER**



New Swedish Volvo Car

(Continued from page 29)

hicles in Sweden, Volvo accounted for 6.5 per cent of the passenger cars, 28.2 per cent of the trucks, and 43.1 per cent of the buses. During that year about 47,200 new vehicles were registered, 36,100 passenger cars and 11,100 trucks and buses. If its new program materializes it will be possible for the Volvo concern to cover almost 30 per cent of the registration of new passenger cars and about 70 per cent of the registration of trucks and buses, assuming that future annual registra-

tions will correspond to those of 1939.

The total number of motor vehicles registered in Sweden in 1939 was 181,000 passenger cars, 63,000 trucks and 5000 buses. The importation of small German cars, especially the four-seater DKW, was exceptionally large that year, but these imports will probably be eliminated in the postwar years. In 1939 American firms exported 10,771 cars to Sweden and in 1938, the last full peacetime year, 13,986 passenger cars were exported from the United

States. In January, 1941, American cars accounted for 60 per cent of the Swedish registration. Ford and General Motors maintain plants at Stockholm. Before the war the Ford plant distributed passenger cars, trucks and service parts supplied from the Ford plant at Copenhagen, Denmark, now held by the Germans. At present the Ford plant at Stockholm is making and servicing gas generators and reconditioning trucks, service parts being supplied locally. The General Motors factory was operated as an assembly plant prior to the war, but according to the latest reports is building gas generators, trailers and semi-trailers, auxiliary axles, electric tricycles, Frigidaires and automotive replacement parts.

The Volvo company recently exhibited its latest models at an automotive show in Stockholm. On that occasion, the new Volvo passenger car, the PV-444 (PV means "popular-vikt," popular weight), was shown to the public for the first time. Volvo agents in the largest cities simultaneously showed this car and accepted orders for it. The PV 444 should be ready for delivery in early autumn and the company expects to produce about 8000 this year. A report from the American legation in Stockholm says the PV 444 gives the impression of being a quality automobile. In design it appears to be a combination of General Motors and Chrysler styling. The rear portion resembles a late model Pontiac, while the front

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By Arthur A. Schwartz
Chief Tool Research Engineer
Bell Aircraft Corporation

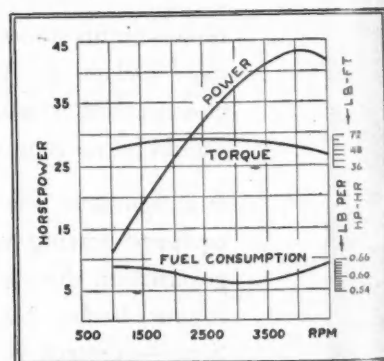
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this method is rapidly displacing other cutting methods. Learn all about it and the machines that make it possible —

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HIGH SPEED BAND SAWS

THE TANNEWITZ WORKS GRAND RAPIDS 4, MICHIGAN



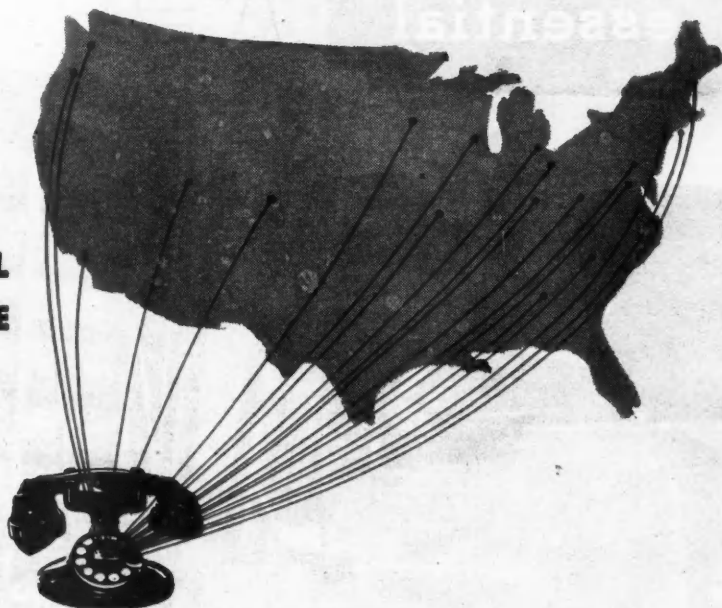
Power, torque, fuel consumption curves for B4B (Penta) engine operating on 25 per cent alcohol, 75 per cent gasoline.

appears to be an adaptation from Chrysler styling. The car is a compromise between good streamlining and consideration of adequate space. With this new car, Volvo intends to compete with other cars in the low weight class, but it is emphasized that the PV 444 is not a small car.

The PV 444 is a two-door type, but the doors are exceptionally wide, providing easy access to the rear seat. Like most European small cars, the chassis frame is not constructed as a separate unit, but is incorporated with the body. This has made possible considerable saving of weight and a lower center of gravity. Coil spring suspension is used at the front and rear. The

MAINTENANCE

**A NATIONWIDE ELECTRICAL
REPAIR SERVICE...AS CLOSE
AS YOUR TELEPHONE**



Men who have helped to build electrical equipment naturally know the most about repairing it. That's the solid basis upon which Westinghouse "Factory-Proved" Maintenance is founded.

This nationwide service organization thus offers you an important plus value—"Factory-Proved" repair and engineering service on a *local* basis.

In the Westinghouse Field Engineering and Service and in the near-by Manufacturing and Repair plant, are men who have spent years acquiring electrical "know-how". They have helped to build motors, generators, controls. They have been specially trained in factory methods of reconditioning and repair.

Backing them up is the most modern type of precision equipment. Testing is handled according to rigid factory specifications—including high-frequency testing, dynamic balancing of rotating parts, fatigue tests, etc.

Because of these special facilities and methods,

Westinghouse is in a position to give you—through its District Offices and repair plants *in or near your own city*—the same guarantee on repaired equipment as on new equipment.

Don't overlook the advantages of this "Factory-Proved" repair service in keeping your electrical equipment at peak efficiency. Call nearest Westinghouse Office for prompt service on any repair job—inside or outside your plant.



**FOR PROMPT SERVICE ON
RENEWAL PARTS**

... call your Westinghouse Sales Office. Ample stocks of Westinghouse factory renewal parts are available at all times. To speed minor repairs, build up your own stocks of parts most subjected to wear.

Westinghouse Electric & Manufacturing Co., P.O. Box 868, Pittsburgh 30, Pennsylvania. J-96001

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PLANTS IN 25 CITIES OFFICES EVERYWHERE

Maintenance Service

an every
day
essential

Unskilled labor adds nothing to a
product except cost



There's nothing like
a good
CLARK fork truck,
Gas or Electric Powered
—to move materials.
Their value can't be
overlooked.

CLARK TRUCTRATOR

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Products of CLARK • TRANSMISSIONS • ELECTRIC STEEL CASTINGS
AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
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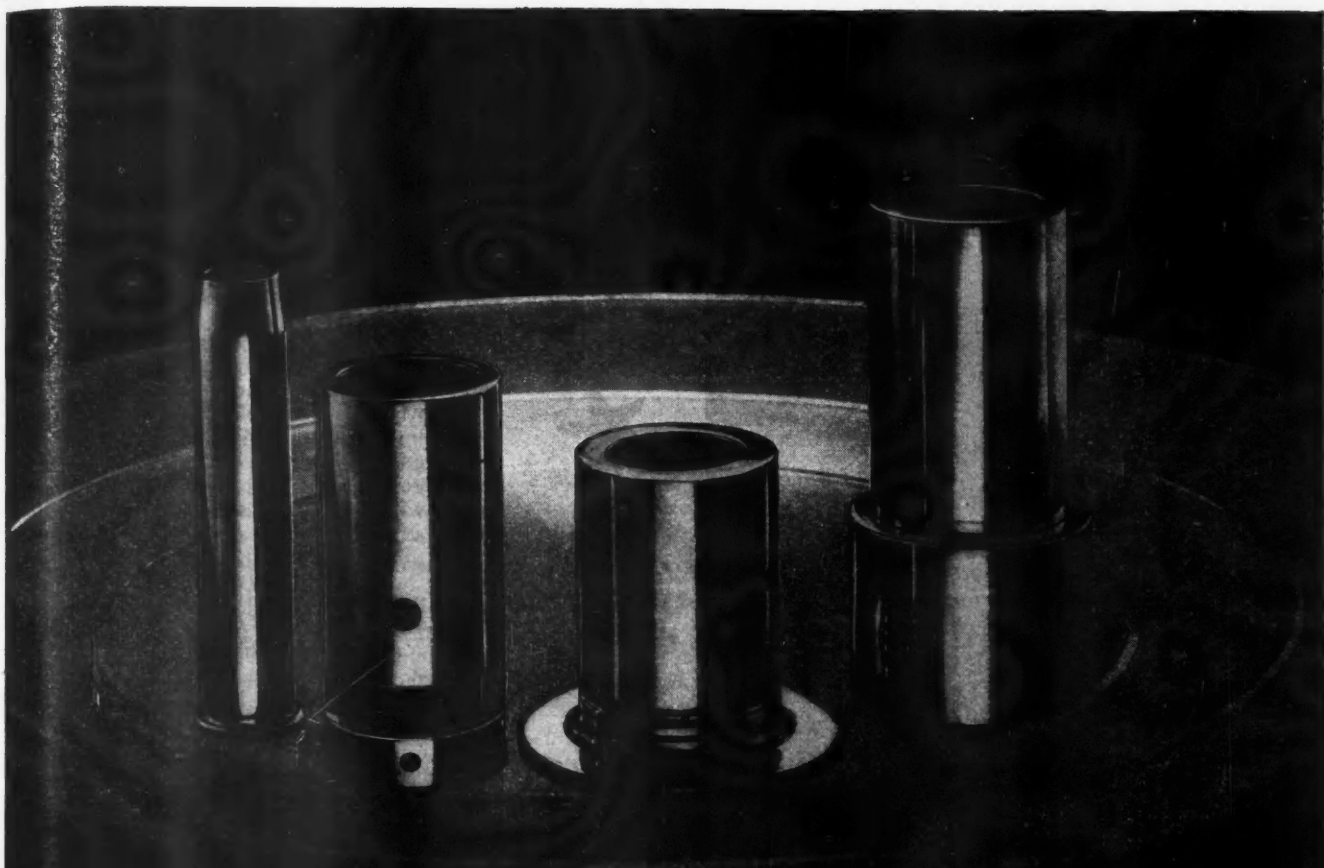
PV 444 has been thoroughly tested, five cars having been driven a total of 125,000 miles, under differing roads and climatic conditions, before presenting the new model to the public. Specifications of the PV 444 other than those given in the accompanying table follow:

Service weight	2200 lb.
Number of passengers...	Four
Engine	Penta B4E
Compression ratio	6.5 to 1
Main bearings	Three
Lubrication system	Pressure (gear pump)
Ignition system	6 - volt battery with vacuum regulation
Engine mounting	Three-point
Transmission	Three - speed (synchronized in 2nd and 3rd)
Gear ratios	First—3.58 to 1 Second—1.62 to 1 Third—1 to 1 Reverse—3.24 to 1
Clutch	Single dry plate 8-in. diam.
Universal joint type.....	Spicer with sealed needle bearings
Rear axle	Semi-floating, spiral bevel ring gear
Rear axle gear ratio.....	4.7 to 1
Wheels	Pressed steel plate, rim, 3.50 in. by 16 in.
Tires	5.00 in. by 16 in.
Brakes	Hydraulic, 9 in. diam. drum
Shock absorbers	Hydraulic, telescope type
Gasoline tank capacity..	9½ U. S. gal.

The PV 444 is equipped with a manual starter and downdraft carburetor. Lights and other electrical equipment are of the German Bosch make. The company claims that the engine is free from knock on 65 octane fuel. The price of this car will be Kr. 4800 (about \$1120, plus the usual sales tax of 5.3 per cent). Although the PV 444 is more expensive than the other European models in the same class, the car is larger and has been designed for the type of roads encountered in Sweden. For this reason, Volvo company officials do not greatly fear the competition of the other models.

The Volvo six-passenger car, PV 60, is not a complete new model, but a modernized successor to the PV 50 car. This car has been ready for a long time and is reported to have been thoroughly tested. It is not streamlined, and retains the lines of the PV 50 with certain small changes, closely resembling an American model of about 1939 vintage. Some of the more important specifications of the PV 60 follow:

Service weight	3480 lb.
Number of passengers.	Six
Wheelbase	112 in.
Tread—front	56 in.
rear	52 in.
Total length	186 in.
Maximum width	71 in.
Engine	Penta ED.
Power	90 hp at 3500 rpm
Piston displacement ..	224 cu in.
Number of cylinders..	Six
Bore and stroke.....	3.31 in. by 4.34 in.
Valve arrangement ..	Side valves

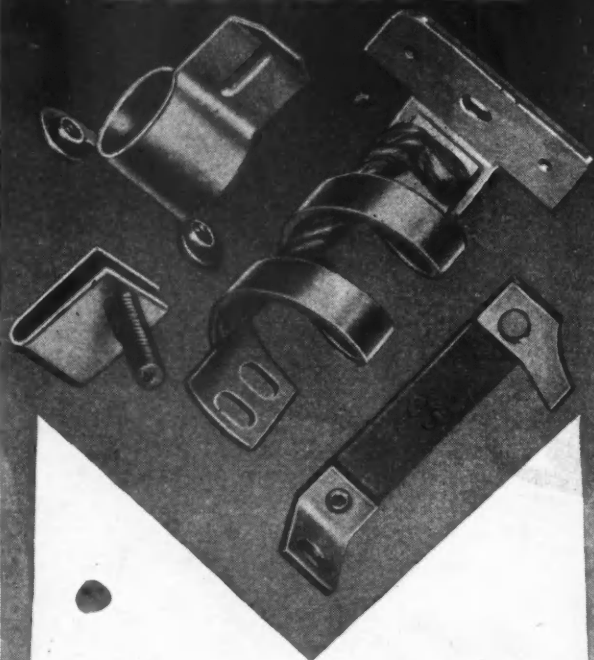


Bunting today produces Cast Bronze Bearings of superlative quality... In precision, in fineness of finish, in uniform physical and metallurgical qualities they surpass any Cast Bronze Bearings ever before produced in volume... Developed for war they are fit for the finest machines of peace. The Bunting Brass & Bronze Company, Toledo 9, Ohio. Warehouses in principal cities.

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CHACE Thermostatic BIMETAL



35 types of Chace Thermostatic Bimetals in sheets, strips, shapes to specifications, and sub-assemblies are being supplied to manufacturers for use in vital instruments and controls for planes, ships, tanks and trucks.

Chace is always ready and anxious to cooperate with you on any problems pertaining to actuating elements for temperature responsive devices.

W.M. CHACE Co.
Manufacturers of
Thermostatic Bimetals and Special Alloys
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Transmission	3-speed with syn-
	chronized gears
Gear ratios	First—2.57 to 1
	Second—1.55 to 1
	Third—1 to 1
	Reverse—3.48 to 1

Lighting and other electric equipment on the PV 60 are also of the Bosch make. The price of this car will be Kr. 7400 (about \$1760), plus the tax.

Volvo exhibited 14 types of trucks and buses at the show, mostly in chassis form and equipped with gasoline engines built by Pentaverken, the Volvo engine subsidiary. A few trucks were equipped with the Hesselman oil engine, which is available for customers desiring this type. At the present time, all gasoline engines are equipped with gas generators. Volvo also offered a truck with a load capacity of 4½ short tons and a bus with a wheelbase of 166 in. to 205 in. equipped with a six-cylinder German MAN Diesel engine, which is built on license by Pentaverken.

The 4½-ton, four-wheel drive truck chassis (see illustration) exhibited at the show can be equipped with either a six-cylinder gasoline or Diesel engine. The front wheel hubs permit mounting of dual wheels. The following specifications for this TLV 141 truck were announced:

Gross weight	17,650 lb.
Chassis weight	6,600 lb.
Service weight	8,475 lb.
Wheelbase	150 in.
Gear ratios	First—6.55 to 1
	Second—3.70 to 1
	Third—1.82 to 1
	Fourth—1 to 1
	Reverse 7.98 to 1
Rear wheel drive ratio	1 to 1
Four-wheel drive ratio	1.76 to 1
Rear and front axle ring gear - pinion ratio	6.83 to 1

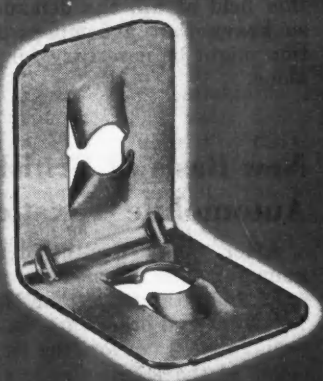
Specifications of the six-cylinder gasoline engine for TLV 141 truck:

Power, max.	105 hp at 2500 rpm
Bore and stroke	3.93 in. by 4.72 in.
Piston displacement ..	3.44 cu in.
Compression ratio ...	5.7 to 1
Torque, max.	260 lb-ft
Main bearings	Seven
Bearing surface	25.6 sq in.

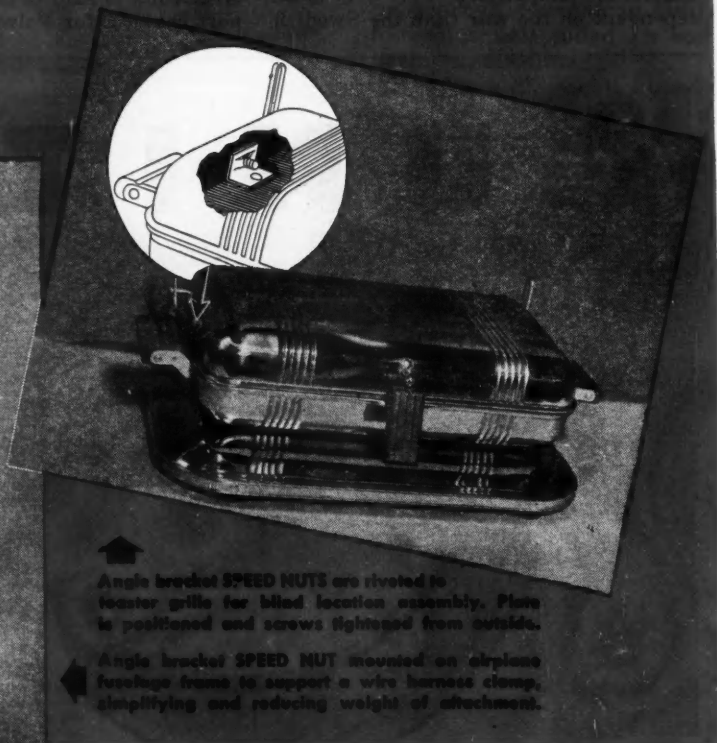
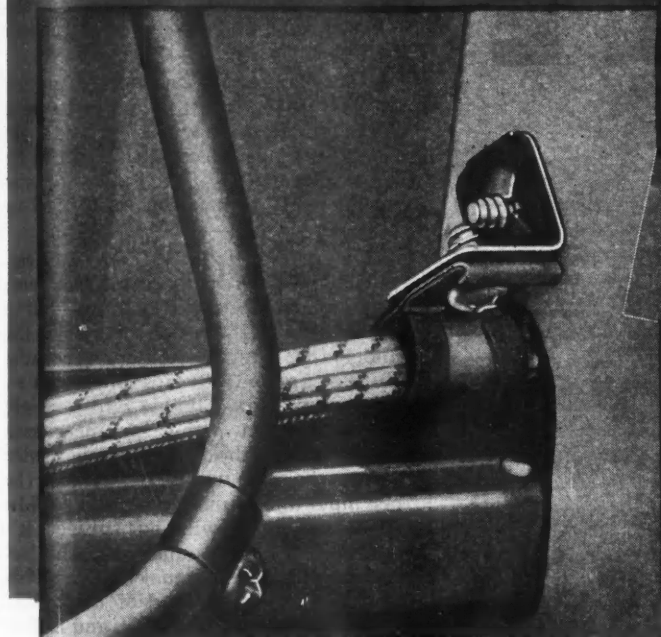
Specifications of the six-cylinder Diesel engine for TLV 141 truck:

Power, max.	95 hp at 2000 rpm
Bore and stroke	3.93 in. by 5.12 in.
Piston displacement ..	3.73 cu in.
Compression ratio ...	17 to 1
Torque, max.	254 lb-ft
Main bearings	Seven
Bearing surface	32 sq in.

Among the most interesting of the truck exhibits was a six-wheel drive truck furnished with certain features providing for operation in extremely rough terrain. The truck was built for military use only, with a load capacity of 15½ short tons. In the front and rear of the front axle, there is a pair of idler wheels, raised above the ground level to such height that when passing over a ditch they take the load without permitting the main front wheel to touch the bottom of the ditch. This truck also has two gearshifts with eight



ANOTHER ASSEMBLY *Cost Cutter...*



Angle bracket SPEED NUTS are riveted to radiator grille for blud location assembly. Flare is positioned and screws tightened from outside.

Angle bracket SPEED NUT mounted on airplane fuselage frame to support a wire harness clamp, simplifying and reducing weight of attachment.

ANGLE BRACKET AND SPEED NUT COMBINED

If your product requires brackets for assembly, why not use brackets with self-locking nuts built right in them? Why fumble around with separate lock washers and threaded nuts and use a wrench besides to keep them from turning? Why handle 9 parts (bracket, 2 screws, 2 lock washers, 2 nuts, screw driver, and wrench), when 4 parts will do a better job? (SPEED NUT, 2 screws, and screw driver.) Think of the savings in manhours and material this could mean in your plant!

These SPEED NUTS lock with a firm spring tension

TINNERMAN PRODUCTS, INC.

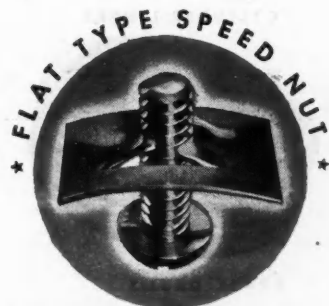
2059 Fulton Road, Cleveland 13, Ohio

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario

In England: Simmonds Aerocessories, Ltd., London

that permanently prevents vibration loosening. They reduce weight, speed up assembly, and strengthen the structure. And since they are produced on high speed automatic machines, these self-locking brackets are not expensive.

Hundreds of manufacturers have improved both their products and assembly methods by changing over to Tinnerman angle brackets. Write for samples.



THE BASIC PRINCIPLE
of Spring-Tension Lock is
Embodied in all Speed Nut Designs

Speed Nuts
PATENTED * Trade Mark Regd. U. S. Pat. Off.
FASTEST THING IN FASTENINGS

March 1, 1945

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speeds. The engine is either a 140 hp gasoline or Hesselman type.

Many different opinions have been expressed regarding Sweden's postwar demand for motor vehicles. Putting them all together it seems fairly certain that in so far as gasoline and tires are available, the demand for new cars will be great, probably greater than ever before. When and to what extent the importation of American cars and trucks will be renewed is naturally of great interest to the dealers, but there seems to be a widespread opinion, according to consular reports, that the Volvo company will be ahead of its American competitors who are more dependent on the war than the Swedish

concern. It is believed that a great number of purchasers will have placed their orders for the Swedish cars before the American exporters or assembly plants are ready to start operations.

Of Volvo's prewar annual production of 5000 trucks and buses and 4000 passenger cars, 2000 vehicles were exported, mostly trucks and buses, to Southern Europe, North Africa, South America, Norway and Finland. According to the general manager, quoted in the Swedish press, the Volvo company has no ambition to expand east of Suez, but will develop the small countries as its sales territory. However, Argentina is said to be an excellent export country for Volvo, but the success

there is said to depend greatly on the American shipping rate competition. Relative to Russia, the company appears to fear that if it were to enter this field at all, the demand might be so heavy that a complete reorganization might be necessary for this export alone.

New Basis of British Automobile Taxation

After many months delay in announcing his decision in response to appeals by the Society of Motor Manufacturers and other interests for a new basis of car taxation, the British Chancellor of the Exchequer has announced his acceptance of the proposal that a cubic capacity basis should take the place of the so-called horsepower rating (based on cylinder bore and number of cylinders).

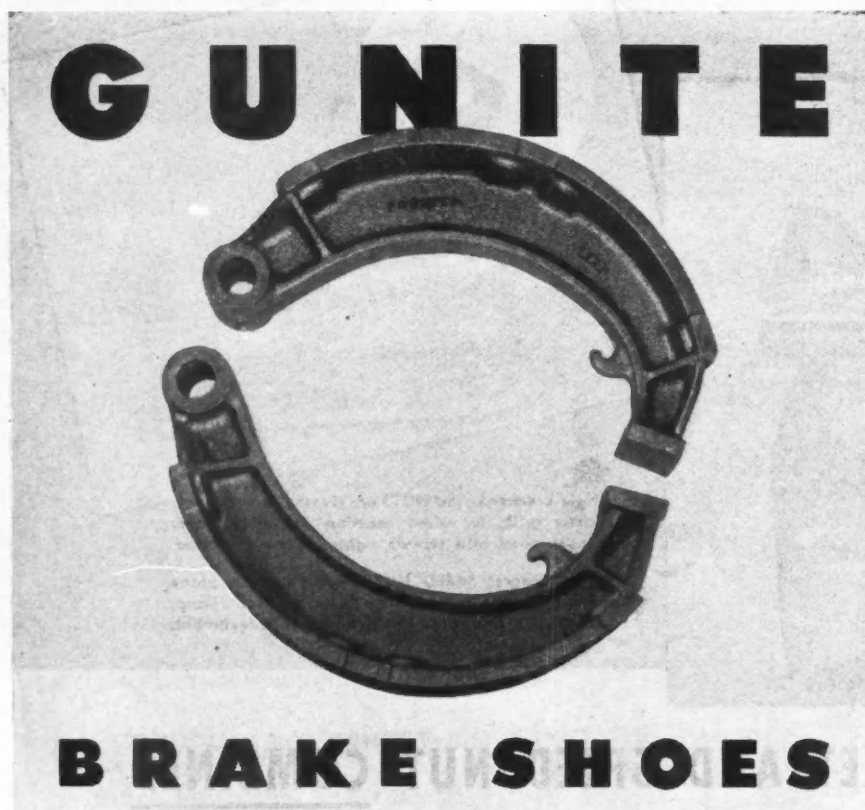
The change will be effective as from Jan. 1, 1946, but it has yet to be decided whether it will then be applied solely to cars registered for the first time on and after that date or whether it will apply to existing registered cars as well.

The rate is to be £1 per 100 cubic centimeters. At this rate the annual tax on small cars will usually—but not in all cases—be somewhat less than under the existing horsepower rating. But as applied to cars of 14 hp and upward the tax payable will be higher as a rule, in some instances much higher. Thus the 27-hp Humber, which before the war was taxed £20.5s. (15s. per hp) and during the war £33.15s. (25s. per hp), will be subject to a tax of £41 per annum when the basis becomes £1 per 100 cu. cm. The 40-50-hp Rolls Royce, instead of being taxed £38.5s. as before the war and £63.15s. during the war, will carry a cubic capacity tax burden of £73 per annum (approximately \$292.00).

One of the few exceptions to the general rule that cars of high power, on British standards, will be taxed at a higher figure on the cu cm basis is the 30-hp Ford V 8. Its annual tax will be £36 as compared with £37.10s. with the hp tax at 25s. per hp and £22.10s. before the war at 15s. per hp. In contrast, the 30-hp Studebaker, taxed the same amount as the Ford both before the war and during the latter, will be taxed £41 under the cu cm basis, i.e., £3.10s. more than the Ford. Similar divergencies occur in a number of instances, though not even these alter the fact that, on the whole, the cubic capacity tax will favor small cars and penalize large ones.

For that reason, one of the chief criticisms of the hp tax, i.e. that it encouraged the production and use in Britain of small cars that lack appeal to a considerable extent in export markets, will apply also to the new basis. The latter, it is true, will not restrict designers quite so much as the hp

(Turn to page 98, please)



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QUALITY CASTINGS MADE TO DO THE JOB

Efficient engineering and production methods with careful laboratory control — these factors combine to assure you that Gunitite Foundries castings will meet your requirements. We specialize in certain automotive items shown here — Brake Shoes, Cylinder Liners, and Brake Drums. Drums are completely finished in our own machine shop. With a backing of 90 years of experience and steady growth, we are equipped to cast ALL ferrous metals — gray iron, Gunite, malleable, and steel — on a quality basis. *Let us quote on your requirements.*



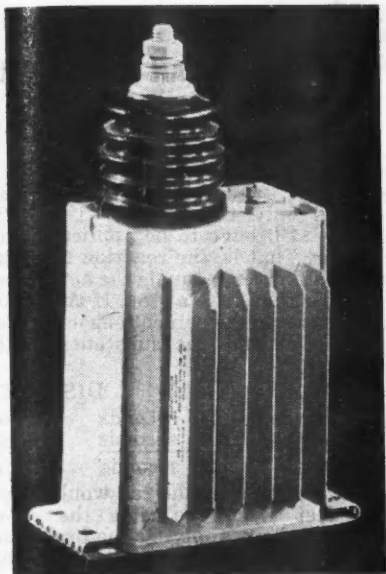
GUNITITE CASTINGS...FOR TRUCKS, TRACTORS, TRAILERS, and BUSES

New Products

(Continued from page 40)

High-Frequency Capacitors

A new line of high-frequency paper-dielectric capacitors, available in ratings of 5000 to 20,000 volts d-c, 0.01 microfarad, is being offered by the General Electric Company, Schenectady, N. Y. Developed primarily for grid- and plate-blocking service in the electronic-oscillator circuits of high-fre-



G-E paper-dielectric capacitor

quency induction-heating equipments, they can also be used to advantage in other high-frequency oscillator circuits of a similar nature.

The high-voltage paper-dielectric capacitors are of relatively high capacitance for high-frequency units, and yet they are more economical than the conventional high-frequency units of considerably smaller capacitance values. They can, therefore, be applied with savings in cost as well as reduced losses and lower voltage drop across the capacitor.

Trimount Carrier System

A carrier system for use with dynamic pressure gages and other instruments has been originated by Trimount Instrument Co., Chicago, Ill. The system is designed particularly for aircraft test work involving boundary layer studies, air foil pressures, and other specialized applications; internal combustion induction system pressures; and for general industrial use. It is available in two series—one making use of the modulated carrier wave principle, while the other employs a discriminator circuit. Frequency ranges are as high as 10 kc. The power supply and oscillator are small, compact, and lightweight, and can be furnished in any number of channels required.

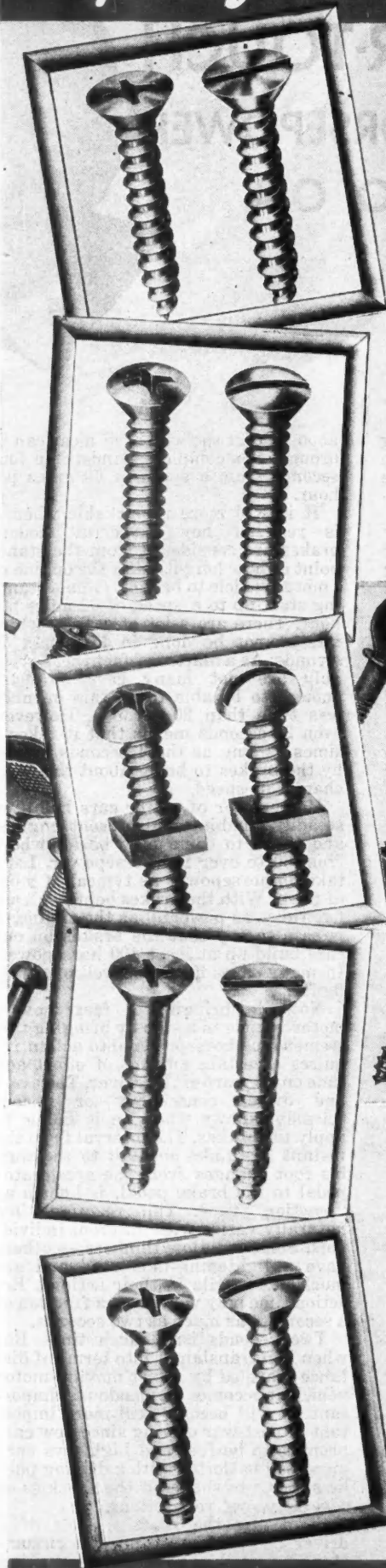
(Turn to page 70, please)

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WITH HOLTITE Fastenings

In your present and future production plans, careful consideration should be given in determining the type of fastenings best suited for each particular application.

Eliminate all doubts by submitting your fastening problems to our Engineering and Laboratory Staffs. They will complete your production picture by recommending the most efficient, economical method of fastening the vital parts of your products. Specify HOLTITE engineered fastenings — made with the precision of small tools



Cut fastening time in half by changing to HOLTITE-Phillips Recessed Head Screws and bolts. Replace hand driving with safe spiral and power driving even on finished parts. The tapered bit cannot slip from recessed head to spoil work or injure operator. Adopt this modern screw driving method as standard practice to reduce fastening time an average of 50%!

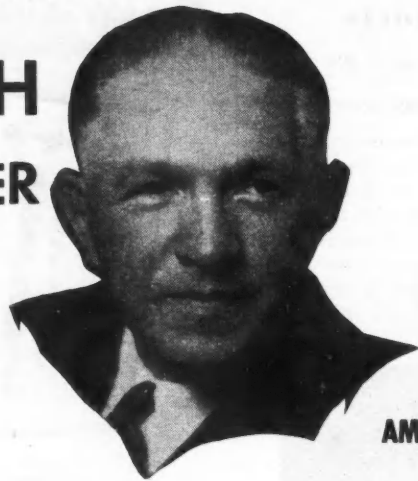
CONTINENTAL SCREW CO.

New Bedford, Massachusetts, U.S.A.

A FEATHER-TOUCH

...AND 400 HORSEPOWER

BRAKES GO ON



By B. M. IKERT
Service Editor

THE
AMERICAN AUTOMOBILE

POSTWAR motor car advertising will no doubt stress once more the great packages of power under the hoods of vehicles fresh from the production lines.

But, by and large, they'll probably forget about the over 400 horsepower brakes that will be called upon to bring these vehicles to a safe, smooth and quick stop — if necessary — and do so with no more energy than that of a child's foot on the brake pedal.

Sure, the American public wants performance when it tromps down on the accelerator pedal. It likes that feel of reserve power.

But it's just as important — and indeed, probably more so — that there be power to slow down or stop the motor vehicle once it has been placed in motion.

Present-day brakes can slow down or stop a motor vehicle very fast. And, yet, rarely do you ever find anyone boasting about the horsepower of the brakes — horsepower far in excess of that in the engine.

First of all, there is stored up in a moving motor vehicle a tremendous amount of energy. This is energy of motion or what we learned at school in the study of physics as "kinetic energy". Slowing down or stopping of the vehicle is done by the brake mechanism wherein the brake lining rubs against the brake drums of the wheels. This process changes the kinetic energy or energy of motion into heat energy.

If the weight of the moving car is doubled the kinetic energy also is doubled, at all speeds. There is, therefore, twice as much energy of motion to change into heat energy every time the driver of the car slows down or stops the vehicle. The same ratio holds for all changes in weight. If there is three times as much weight to be stopped, there is three times as much heat to be dissipated by the brake drums. And so it goes.

All of us know that motor cars of postwar days will travel at high speeds again and be able to stop safely from these high speeds. Now, when one figures how fast stops may have to be made, several very important factors come into the picture.

A motor vehicle possessed of good brakes can be brought to a stop easily in 4 seconds from a speed of 60 miles per hour. That means the vehicle will stop in a distance of 176 feet. It is quite remarkable when one stops to think

about it that the weight of a car can be brought to a complete standstill in four seconds from a speed of 60 miles per hour.

It is still more remarkable when it is realized how powerful modern brakes are considered from the standpoint of how long it takes the engine of a motor vehicle to bring it from a standing start up to a speed of 60 miles per hour. There are a lot of cars in which this cannot be done in less than 30 seconds. As a matter of fact there probably are not many cars powerful enough to be able to do this in much less time than 20 seconds. However, even 20 seconds means that it takes 5 times as long as the 4 seconds needed by the brakes to bring about the same change in speed.

Horsepower of motor cars has been steadily climbing and present engines and those to come may be anywhere from 60 to over 100 horsepower. Let's take 85 horsepower as typical of most of them. With the brakes being at least five times as powerful as the engine, it is safe to say that the brakes on our cars build up at least 400 horsepower. In many cases it will be well over this figure.

Now, in bringing a fast moving motor vehicle to a stop by bringing this tremendous horsepower into action requires a certain amount of effort and time on the part of the driver. The average driver consciously or unconsciously, knows when he is going to apply the brakes. The interval from the instant he thinks about it to the time his foot changes from the accelerator pedal to the brake pedal, is known as "reaction" time. This reaction time naturally varies with different individuals. Some are slow thinkers — others have a lightning-like mind and are much more agile in their actions. Reaction time may vary from a fraction of a second to as much as two seconds.

Two seconds isn't much time. But when you translate it into terms of distance traveled by a fast moving motor vehicle it becomes tremendously important. It will become still more important in post war driving since new cars promise to be fast and highways once more will be dotted with a driving public anxious to shake off the shackles of several years' restrictions.

Supposing the reaction time of a driver is $\frac{3}{4}$ of a second and circumstances force him to stop the car going 60 miles per hour. At this speed the car covers a distance of 66 feet driving

during $\frac{3}{4}$ seconds time. But remember this is only the "action" time. The brakes still have to be applied to stop the car. That is, the reaction time plus the braking time equals the actual time to bring the car to a stop. If the brakes on the car are 50 percent efficient, let us say, we would get substantially the following:

TIME	DISTANCE
Reaction time .75 seconds	66 feet
Braking time 5.45 seconds	240 feet
Total 6.20 seconds	306 feet

So, we see that the car would travel 306 feet from the time the driver thought about applying the brakes until the car actually came to a stop. Brakes in better condition would, of course, permit of a quicker stop, but with brakes and driver reactions being on the average about 50 percent of the ideal, the foregoing figures probably represent prevailing conditions.

We cannot change the ratio of car speed and distance. At 30 miles per hour a car always will travel 44 feet a second. Nothing can be done to change these figures. But something can be done to cut down the lag of time in applying brakes so that no matter how tired the driver a light touch of the pedal effectively and easily stops the car. Instead advantage is taken of the common forces such as atmospheric air pressure and the vacuum existing in the intake manifold of the engine in the motor vehicle.

A railroad engineer brings a half-mile long train to an easy stop. His strength does not enter into the problem at all.

Nor should the car driver's strength enter into the problem of stopping his car. Like the railroad engineer the driver with power braking, merely puts his foot lightly on the brake pedal and then, vacuum and pressure go to work for him. These two forces will do it so much more quickly and positively that no driver can compete with them. Besides—and this is important—vacuum and pressure never get tired or confused, no matter what the emergency. All the driver of a well "braked" car need do is give the brake pedal a light touch whereupon the booster action goes into effect so smoothly that the driver is not aware of it.

Power braking with feather touch control will supplant the "leg muscle" act of the driver just as electric starting shelved muscle power in cranking engines.



Feather touch
STOPABILITY

**"WE MUST, WE WILL HAVE
BETTER BRAKES - *and soon*"**

"We have set a decelerating rate equivalent to a 30-ft. stop from 20 mph as our current standard. Yet we know that this will not only be inadequate for post-war conditions, but is inadequate today!"

So says Merrill C. Horine, well known automotive authority, in his article "The Shape of Trucks to Come" in the November S.A.E. Journal.

Manufacturers, fleet operators and individual owners of commercial vehicles have come to recognize efficient stopability as a "must."

On trucks, buses and passenger cars, Vacdraulic split-second, feather-touch

brake action reduces accidents, checks pay-load delays and is a definite "handling" asset.

Vacdraulic—the Power Braking Booster is simple yet effective in operation. There is no action lag . . . no rods or links to get out of adjustment.

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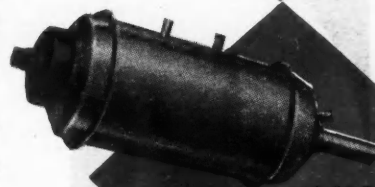
**VACDRAULIC
MODEL 50**

Passenger Cars
and Light Trucks



**VACDRAULIC
MODEL 150**

Medium Trucks



**VACDRAULIC
MODEL 310**

Heavy Duty
Trucks



**VACDRAULIC
MODEL 240**

Medium Heavy
Trucks

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There's a big difference in metal parts marking, not only in the various methods used, but in the actual results obtained. Electroetch unit on the market. First, because of its simplicity in operation, using no acids, no heat, shock, stress, strain, or deformations, on parts marked. Second, because the new, exclusive, long-life interchangeable plastic button-type stencil, developed and perfected by Electroetch, is a revelation in parts marking. It marks parts clean, sharp and legible, and what is highly important, you can make fifty to one hundred thousand markings from one stencil under ordinary conditions. It is ideal for marking flat, cylindrical and odd-shaped parts and will not interfere with surface tolerances. Inexpensive plastic locating fixture assures consistent, uniform register of marking on all parts. Electroetch Bench Unit can be operated manually or automatically, and will handle intricate designs, or trade marks, as easy and legibly as ordinary characters.

If you have a metal parts marking problem, let us hear from you. Chances are we have the answer in one of our Electroetch units. Send in for free literature on the complete Electroetch line.

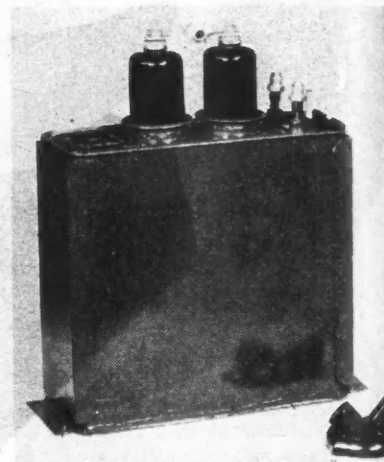
The ELECTROETCH Co.
1727 DOAN AVE. • CLEVELAND 12, OHIO



Parallel Plate Capacitors

A line of high-frequency, parallel-plate capacitors, designed for use in the resonant circuit, or "tank circuit" of high-frequency electronic oscillators such as those used in electronic-heater equipments, has been developed by the General Electric Company, Schenectady, N. Y. When connected in parallel with an inductance coil, this class HFP, water-cooled capacitor constitutes the resonant circuit which determines the frequency of the oscillator.

In this application the capacitors are operated at relatively high voltages and



G-E high-frequency, parallel-plate capacitor

may be required to carry heavy currents continuously at frequencies up to several megacycles. The following features are said to make them particularly suitable for this type of service: Low losses at high frequencies; uniformly high dielectric strength; high current rating per unit volume; and convenient mounting and connection facilities. These units are available in standard ratings ranging from 2000 volts, 0.025 microfarad to 9000 volts, 0.0056 microfarad.

New Development in Diesel Engines

A new discovery in the Diesel engine field, which will enable the engine operator to use either gas or oil as fuel without any electrical sparking device, and which is said to cut fuel consumption of gas engines by from 20 to 25 per cent, was revealed by The Cooper-Bessemer Corporation, Mount Vernon, Ohio.

The conversion from liquid to gas fuel is said to be as simple as the closing of one valve and the opening of another with the engine operating continuously at full load.

**At the Front
They Are Giving Their All
Now Give Your Little**

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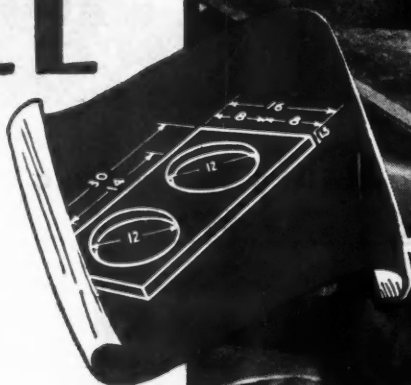
To bore 12" diam. holes in a 30" plate 1½" thick required only 1 hour each on the DoALL. A lathe could not swing the 30" plate, which had to be cut into two 15" plates and then it took 3 hours to bore each hole.

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Successful warfare—and successful manufacturing, too—is waged by men who want to serve, and who have the ability and equipment to win.

We here at Aircraft Mechanics, Inc., have served many major manufacturers as sub-contractors throughout the war period. As a result, each of us participating in the flow to war essential production lines of high tensile steel forgings and welded tubular assemblies, has become skilled in his job. Each, also, has learned how to cooperate with the other worker so that a high standard of efficiency is gained.

Thus, we can offer any manufacturer a sub-contracting service which provides the goods ordered at the time specified, and at an economical cost.



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BUY AN EXTRA WAR BOND



★ AIRCRAFT MECHANICS INC.

COLORADO SPRINGS, COLORADO

DESIGNERS • • • ENGINEERS • • • MANUFACTURERS

Manpower Limits Industry Output

(Continued from page 17)

However, interference with management's discharge of its responsibilities has increased. Whereas before the war most strikes and stoppages were over union recognition, wages and hours, today the principal objective of strikes and stoppages in the automotive industry is to defeat action by management to maintain discipline and to further worker, job and plant productivity. Strikes over transfer of employees, production standards, even changes in supervisors, are examples. Not only that, the number of strikes and work stoppages has greatly increased. During the year 1944 there were 1045 recorded strikes and work stoppages in 500 automotive plants. In at least 43 per cent, the issue involved plant discipline and worker, job or plant productivity.

The Government's own Bureau of Labor Statistics tabulation shows that there were more than five times as many strikes in automotive plants in 1943 than in 1940, with 441,123 man-days lost in the wartime year compared to 104,377 in the earlier period. These figures give, of course, only a partial picture of the idle time resulting from strikes as the Bureau of Labor Statistics does not record strikes lasting less than a day nor involving fewer than six workers.

The records of one large automobile company show that in 1944 the work stoppages that occurred as a result of disciplinary action being applied comprised 52.3 per cent of its total compared with 15.6 per cent for similar cause in 1940. Of manhours lost because of stoppages, 82.8 per cent of the total involved disciplinary cases in 1944, compared to 4.4 per cent of the total in 1940.

This evidence of management's interest in maintaining discipline and productivity is remarkable when it is recognized that management has found

(Turn to page 76, please)



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● **RE-SET-ABLE** adds to life of your diamond . . . More work per carat. Exclusive patented setting is tender to the diamond . . . Holds firmly . . . Protects from damage . . . Guards against breakage.

No. 24 CN RE-SET-ABLES are now selling in 100 lots. Ask for easy No. 4 Catalog and Grinder's Instruction Card. Shows sizes to fit your machines. Tools backed by service unequalled.

All diamonds are **LOC-KEY-SET** for immediate shipment . . . Tools numbered in units of 1/8 carat (No. 1 size) and lettered to denote quality of diamond and style of mounting . . . 3 grades—Common (C), Medium (M), Select (S). (24-hour resetting service \$1.00 postpaid.) Bigger stones in C grade are genuine economy in diamond use. For large wheels we recommend No. 60-CN.

DIAMOND TOOL COMPANY, Not Inc. 938 E. 41st Street CHICAGO 15, Ill.

SHELDON M. BOOTH, Pres.



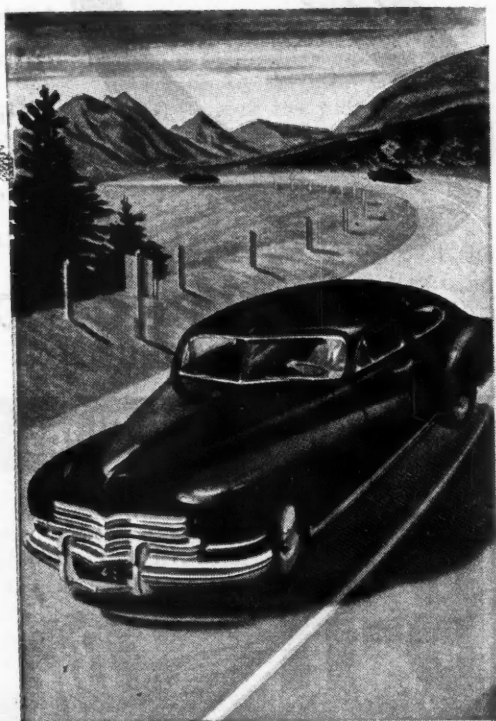
BONDERIZING

IS ESSENTIAL PROTECTION
FOR A MULTITUDE OF PRODUCTS

Because they started out with Bonderizing under the finish, millions of pre-war cars, 3 to 10 years old, have been demonstrating to car owners the extra finish value of Bonderizing.

Bonderizing will be back on the new cars, providing bodies, hoods, fenders with a rust-inhibiting surface that *bonds* the final finish to the metal, prevents the spread of rust from scratch or mar.

Bonderizing will be back, too, on a multitude of other sheet steel products, giving them the extra value of *lasting* fine appearance that means superior quality to the customer when the dealer says, "It is Bonderized."



PARKER RUST PROOF COMPANY

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BONDERIZING • PARKERIZING • PARCO LUBRIZING
HOLDS PAINT TO STEEL INHIBITS RUST RETARDS WEAR

PARKER PRODUCTS CONQUER RUST

March 1, 1945

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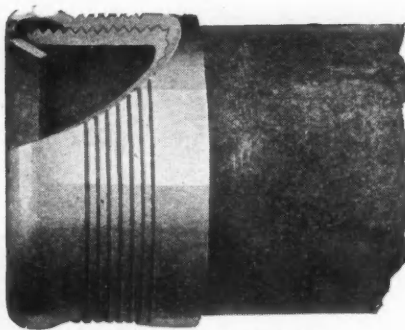
75

Weld pipe with



When you weld pipe with WEDGE Chill Rings with the patented SPLIT Feature you can use LIGHTER WALLED PIPE and save money. WEDGE Chill Rings REINFORCE the joints and, therefore, lighter pipe can be used. Write today.

Split Feature Patented



Patent No. 2,156,169

PROTECT Valuable Parts with



There are many valuable parts, threaded and not threaded, that should be protected against damage while in handling, storage or shipping. WEDGE Protectors are used by many—the cost is low considering the protection obtained. Write.

WEDGE PROTECTORS, INC.

9540 RICHMOND AVENUE

CLEVELAND 5, OHIO

Use WEDGE Chill Rings-Thread Protectors

through experience that Government agencies as a rule will not back the application of sound managerial practices which might involve the application of disciplinary measures objected to by union representatives.

For each case that results in actual strike or recorded stoppage of production there are hundreds of other instances where production is adversely affected or where the safety or welfare of other employees is endangered by irresponsible action, willful disregard of shop rules and unconscionable conduct. In addition, there are many cases involving infractions of plants' rules and regulations such as excessive time spent in the washrooms, smoking, loafing, gambling, reporting to work late, leaving the job before the shift ends, etc.

Correcting such conditions does not always call for the application of penalties, nor should it be necessary to do so, but management should have the authority to "make its decisions stick" on important issues.

Perhaps one of the most dangerous illusions in the country today is the idea that union representatives can assist management in the maintenance of good managerial practices, particularly those involving discipline. There have been a few exceptional cases, but almost invariably they have resulted in partisan efforts to replace these exceptional and responsible union representatives who agreed with management. The political nature of unions precludes acceptance of such responsibility.

Workers, job and plant productivity and plant discipline have been further disrupted by the efforts to unionize foremen. Higher management must depend upon its foremen to maintain worker, job and plant productivity and plant discipline. Yet some workers and union representatives are constantly attacking foremen for carrying out their responsibilities. In a bulletin to members on this subject, one local UAW-CIO Union concluded with the statement—"Therefore to protect their own interests, they—foremen—should work with us instead of against us as

(Turn to page 78, please)

B-H MANUFACTURERS OF SHEET METAL AND TUBULAR ACCESSORIES

CONTRACTORS TO ALL LEADING ENGINE AND PROPELLER MANUFACTURERS

TUBULAR PARTS

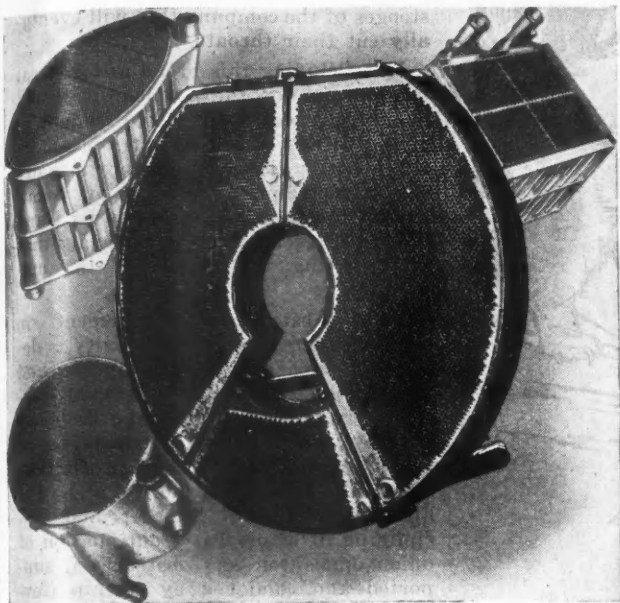
B-H AIRCRAFT CO., Inc. LONG ISLAND CITY 1, NEW YORK

HARDNESS TESTING

The STANDARD SCLEROSCOPE (Now highly improved) for more than twenty years has made good and is still used for doing the world's hard work in testing. In general use for specifications purposes. Simple, Sturdy, Comparatively Inexpensive. Illustrated bulletins free.

FOR QUALITATIVE AND QUANTITATIVE HARDNESS MEASUREMENT, under Static Pressure, the MONOTRON is the only machine now available. Operative up to over 2000 Diamond Brinell. Avoids errors due to spring in test pieces. Takes readings with the load on, avoiding reversal lash errors. No setting to zero. Operates at highest Speed. Has solved many old laboratory and shop problems. We also make the Durometer for testing the hardness of rubber. Comprehensive bulletins free.

THE SHORE INSTRUMENT & MFG. CO.
Van Wyck Ave. and Carll St., Jamaica, New York, N. Y.
Agents in all Foreign Countries



HOW ALUMINUM BRAZING SIMPLIFIES ODD SHAPES

Until recently heat transfer units have been complicated by special reinforcements to give them strength in unusual shapes. At high temperatures the soft solder, which bonds copper tubes to their shells and to each other, could not stand the severe stresses set up by pressure, vibration and shear in *unusual shapes*, unless other weight-increasing supports were added.

ALUMINUM BRAZING CHANGED ALL THAT

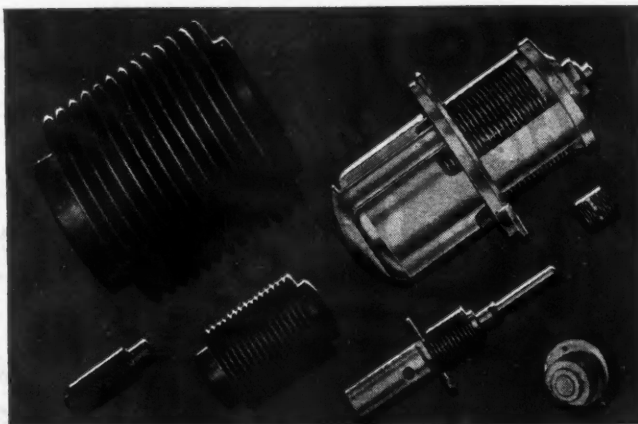
Discovery of a way to braze thin-walled aluminum tubes to aluminum header plates and shells made simply constructed odd shapes possible, for three reasons:

1. Aluminum alloy bonding material defies temperatures, pressures and strains several times higher than soft solder can stand.
2. Heat-treatable aluminum alloy tubes, header plates and shells stand temperatures and pressures that cause copper to anneal and weaken.
3. Aluminum's weight being $\frac{1}{3}$ that of copper affords other obvious advantages to designers of products incorporating heat transfer units.

That's why USAAF designers were quick to take advantage of Clifford's discovery and put Feather-Weights to use in a number of their aircraft models.

POSTWAR PLANNING

Now war orders occupy 100% of Clifford's production... but inquiries and suggestions about postwar applications of all-aluminum heat-transfer units to automotive, heating, cooling and ventilating fields are welcomed. Clifford Feather-Weights... Save $\frac{2}{3}$ the weight... same size and shape. Clifford Manufacturing Co., 563 E. First Street, Boston 27, Mass.



IN HYDRAULICALLY-FORMED BELLOWS

the metal has to be right

Metallic bellows can be made four ways:

1. Built up from a number of sections.
2. Mechanically spun from a welded tube.
3. Mechanically spun from a seamless tube.
4. Hydraulically formed from a seamless tube.

The first and second are as strong as their metal and joints; the third as its tool-scratched metal; the fourth as its metal only.

In hydraulically forming a bellows, no spinning tool touches its surface. It's made by forming the paper-thin walls of a metal tube between the plates of a collapsible die by means of internal hydraulic pressure. And since that pressure is much higher than any pressures it will meet in service, any bellows that survive the forming process must be metallurgically sound.

Therefore, to make hydraulic forming practical the metal from which the tube is made must be free from slag and scale inclusions... and the tube must be free from draw die marks, variations in wall thickness and faulty crystalline structure.

Clifford, being the first to produce hydraulically-formed bellows for industry, not only realizes the importance of metal selection, but also appreciates the critical nature of all processes involved in making bellows assemblies for controlling temperature and pressure; for sealing against pressure leakage; or for other exacting uses. *First with the Facts on Hydraulically-Formed Bellows.* Clifford Manufacturing Co., 563 E. First Street, Boston 27, Massachusetts.

CLIFFORD



OIL COOLERS AND COOLANT RADIATORS HYDRAULICALLY-FORMED BELLOWS



March 1, 1945

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77

**Able to take
on any Size!**



A SINGLE **CENTRAL UNIVERSAL HOSE CLAMP**

FITS OVER 100 DIFFERENT HOSE SIZES

● The Wolverine of the North Woods is a little fellow, but he can whip almost any size animal. The *Central UNIVERSAL Hose Clamp* likewise is able to take on any size—for just *one size* in the *UNIVERSAL* fits over a hundred different hose sizes. (The standard length, for example, fits any hose from 1" to 3" O.D.)

Thus the *UNIVERSAL* eliminates the need for different size hose clamps. And it is powerful enough for all production and service requirements. It is easiest to use in hard-to-get-at-places; has fastest clamping action; goes on or off in a jiffy, without disconnecting the hose line; has plenty of take-up, even on synthetic hose; is rustproof, leakproof, self-locking; can't strip or loosen . . . standard for U. S. combat vehicles.

SEND FOR

FREE
SAMPLE

No. 45-3A

CENTRAL EQUIPMENT CO. 900 S. WABASH AVE.
CHICAGO 5, ILLINOIS

stooges of the company that will eventually cut their throats."

In concluding this broad and general presentation of the problem it should be emphasized that in our judgment most workers want to contribute more to an early victory. It is principally the unrestrained militancy of a minority group of workers, stewards and union representatives and officials that is thwarting this desire of the majority.

Any substantial improvement in worker, job or plant productivity is dependent upon clear understanding and support of the exclusive responsibilities of management to make decisions in such fields as the products to be manufactured, schedules of production, methods of manufacture, and the hiring, promotion, transfer and disciplining of employees. Continuation of union opposition and obstruction, supported and condoned by certain Government policies and officials, to the efficient use of manpower will finally lead to a low standard of living and perhaps to demoralization of our economic system and the anarchy we saw in France at the beginning of the war.

The Price of Freedom

(Continued from page 15)

ing to pay the price for the blessing of such liberty in the new world, no matter what physical suffering was involved. They landed in mid-winter. Before many months had passed, half of their number had died. Yet when the Mayflower sailed home in April, as an old historian says: "Not one of the colonists went in her. So sweet was the taste of freedom even under the shadow of death." Millions of our soldiers and sailors are under that same shadow tonight. May it not be written of us civilians in the fateful years ahead, that we lacked that courage of body, mind and soul, which, when all is said, is the real price of freedom.—From an address before the Union League of Philadelphia. Mr. Prentis is president of Armstrong Cork Co. and a past president of N.A.M.

A Source of Supply FOR AIRCRAFT ENGINE MANUFACTURERS:

- GASOLINE INJECTION EQUIPMENT FOR SPARK IGNITION ENGINES.
- WATER INJECTION EQUIPMENT FOR CARBURETED ENGINES.
- FUEL CHARGING EQUIPMENT FOR JET PROPULSION ENGINES.
- FUEL CHARGING EQUIPMENT FOR GAS TURBINE ENGINES.

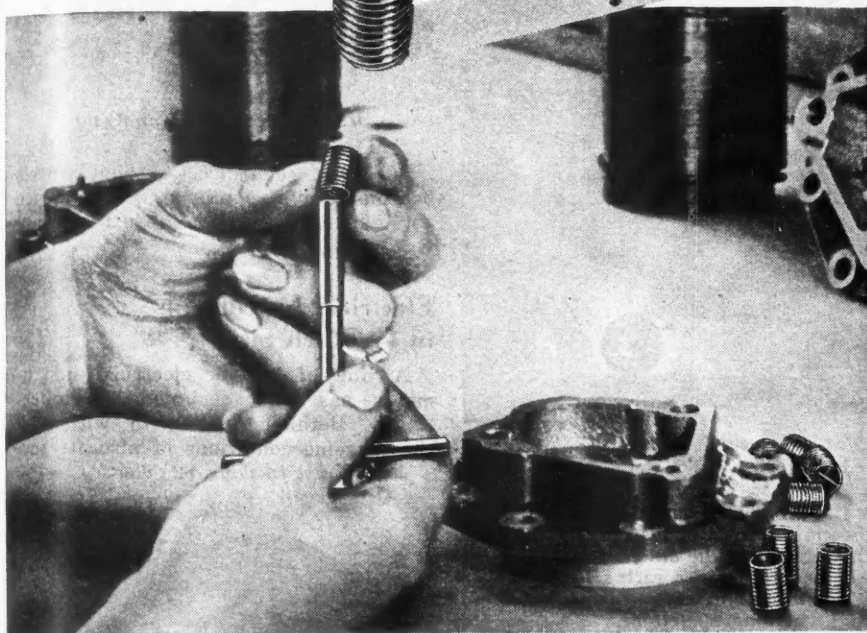
FUELCHARGER CORPORATION

8800 GRINNELL AVE.

DETROIT 13, MICH.

INJECTORS • NOZZLES • MIXTURE CONTROLS • TUBING HARNESS

HOW *Heli-Coil* INSERTS PUT STEEL THREADS IN THIS ALUMINUM FILTER!



The accompanying photographs show how The Cuno Engineering Corporation uses stainless steel Heli-Coil Inserts to protect tapped threads in the aluminum parts of its aircraft engine filter. Where fast-moving, large volume production requires automatic equipment, Heli-Coil Inserts are easily installed with stationary or portable power tools.

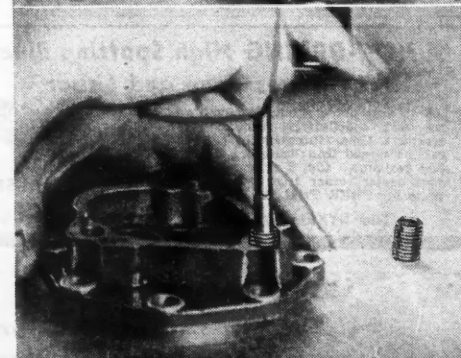
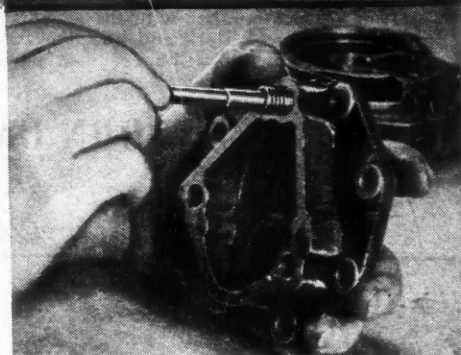
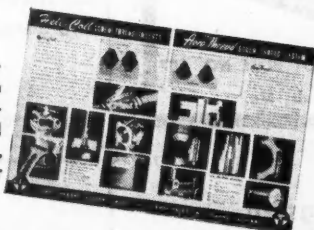
Tapped threads, normally weak spots in light-metal assemblies, become the toughest parts when protected with Heli-Coil Inserts. These precision-shaped wire coils line the tapped thread with stainless steel or phosphor bronze—give it the wear resistance of these hard metals—eliminate abrasion, stripping and seizing.

Heli-Coil Inserts engage fully with American National threads. They are installed in a fraction of the time required for solid bushings—occupy less than half as much cross-sectional area (permitting more latitude in design)—weigh one-fifth as much as solid bushings of the same inside diameter.

Whether your tapped thread problem concerns original installations, salvage, maintenance or field servicing, Heli-Coil Inserts offer a simple, inexpensive solution.

New!

Just published . . . four-page illustrated Bulletin 239 . . . explains principles of Heli-Coil Inserts and the Aero-Thread System . . . tools for installation . . . product applications. Send for your copy today.



AIRCRAFT SCREW PRODUCTS COMPANY, INC.
47-23 35th STREET • LONG ISLAND CITY, I. N. Y.



ELLSTROM Chromium Plated Gage Blocks are the basis of measurement for the close tolerances that are required to build the engines that power these giants of the air.

To maintain their accuracies (to millionths of an inch) longer, each Ellstrom Gage Block's gaging surface is chromium plated—this not only gives you longer wearing millionths in laboratories but also on production checking operations.

If you are not familiar with the advantages of the Ellstrom Gage Block over the ordinary hard steel block and how they save you time and money by their longer resistance to wear, it will more than pay you to write today for our illustrated catalog and price list.



DEARBORN GAGE CO. 22037 BEECH STREET
DEARBORN, MICHIGAN

Originators of Chromium Plated Gage Blocks

**A NON-DRYING High Spotting Blue Paste
Saves Time and Labor**

As it does not dry out, it remains in condition on work indefinitely, hence saves the scraper's time. Intensely blue paste can be spread thin; transfers clearly. 50¢ per tube, 45¢, 3 or more. Ask your dealer, order from this Ad, or write for FREE Trial Tube!



**DYKEM
HI-SPOT BLUE NO. 107**

The DYKEM CO., 2301 L N. 11th St., St. Louis, Mo.



Tantalum-Tungsten
CARBIDE Tools, Blanks and Dies.
TANTUNG Cast Alloy Cutting Tools.

VASCOLOY-RAMET CORPORATION
NORTH CHICAGO • ILLINOIS

**New Products
for Aircraft**

(Continued from page 38)

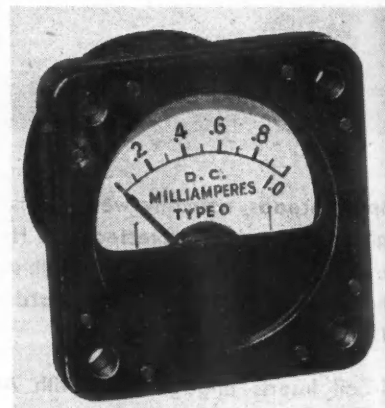


Micro-Linor wheel analyzer

in degrees, regardless of bent wheels or rims, and is equipped with a device for determining and allowing for runway slope.

**Electrical Instruments
in 1½-Inch Size**

A line of 1½-in. electrical instruments has been designed by Roller-Smith, Bethlehem, Pa., to withstand the extreme conditions of aircraft service. (Turn to page 82, please)



Roller-Smith 1½-in. panel instrument

Engineers Available

Consultation
and Service on

**MECHANICAL DESIGN • PRODUCT
DESIGN • DEVELOPMENT OF PRODUCTS
AND PRODUCTION PROCESS MACHINERY
AUTOMOTIVE DESIGN • LAYOUT & DETAIL**

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FRANCIS AND CAPPELLE

1616 Transportation Building, CHICAGO 5, ILLINOIS

**Always Specify
REPUBLIC STEELS
and STEEL PRODUCTS**

PLAST-O-LOCK



Remember them?

We Helped to Build Every One of Them!

It was a familiar sight during peacetime. Nowhere else in the world could you see its equal. . . . It was America on wheels — a nation going places in 30 million automobiles.

And we helped to build every one of them!

But that's not all. Look down that stream of cars all the way to the beginning . . .

Machine tools designed by Jones & Lamson have been used by the automotive industry ever since the first automobile. They helped to make possible the mass production of interchangeable parts which in turn has made possible millions of automobiles. They are now contributing to the greatest feat of wartime production that the world has ever known.

As the oldest machine tool company in America, there are no major industries and few important products, for peace or war, to which Jones & Lamson engineering has not contributed.



JONES & LAMSON

MACHINE COMPANY
Springfield, Vermont, U.S.A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers.

March 1, 1945

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TURNER PLAST-O-LOCK

(Patent Applied For)

GAUGE SAYS



on its NOT GO member!

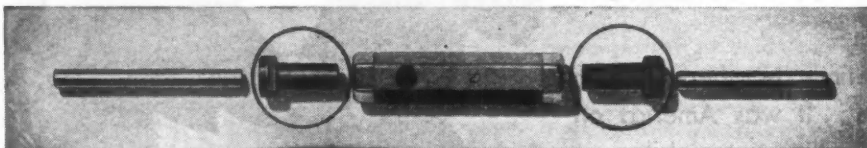
Here's another first by Turner—a red plastic collet to more quickly identify the "not go" member of your plug gauges! Plast-O-Lock gauges are great time savers wherever they are used.

Turner's Plast-O-Lock (patent applied for) collet type plug gauges are not only easier to use but they will multiply the life of plug gauges many times. The reason for this is obvious. Because Plast-O-Lock features a collet of plastic, slotted and tapered to fit into the tapered end of a standard plastic handle, it is possible for the gauges to be held securely without their surfaces being scratched or burred, thereby allowing use of most of the gauge's length. For example, as the "go" and "not go" ends are worn beyond allowed tolerances they are simply cut off, thus leaving an unused end ready for gauging. To illustrate further, if a boring no deeper than $\frac{1}{8}$ " is being checked, as many as 8 fresh gauging sections may be obtained from one standard length "go" gauge as furnished with Turner's Plast-O-Lock. This obviously eliminates the necessity of salvaging used gauges.

For full particulars about Plast-O-Lock gauges wire or write us today.

★ Features ★

1. Multiplies the life of the plug gauge.
2. Collet will not mar a lapped or polished surface.
3. Used with plastic handle the gauge has a more sensitive feel in the hands of an inspector.
4. Is easy to make length adjustment because slot is provided for end wrench.
5. Plast-O-Lock size range from .050 to .690.
6. Red plastic collet for quick identification of "not go" members.



DELIVERY

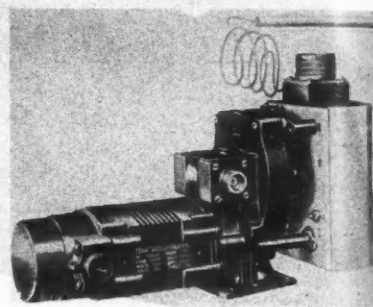
Fast delivery can be made on these Plast-O-Lock gauges as well as the following Turner gauges: ring, flush pin, snap and built up.

TURNER GAUGE GRINDING COMPANY
2622 HILTON ROAD • • • • • FERNDALE, MICH.

vice. They maintain a service accuracy of 2 per cent. Immersion tests are said to have shown their ability to withstand hydrostatic pressures up to 14.7 psi without case leakage.

These new $1\frac{1}{2}$ -in. instruments are available in d-c voltmeters, in all practical ranges above 50 millivolts, and in d-c ammeters in all practical ranges above 500 microamperes. For certain applications lower ranges can be supplied.

Lear Accessories for Army's Giant Plane



Lear power unit 158, with Lear automatic temperature control, which, with Lear 710 flexible shafting and one or two Lear 570 screw jacks, operates control of oil cooler flaps, glycol cooler flaps, and intercooler exit flaps on Army's XB-19A plane.

Advertising Note

Hill and Knowlton, Public Relations Counsel, New York and Cleveland, has moved its Cleveland office from 1454 Guildhall Building to 323 Republic Building.

Both the Republic Building and the Guildhall Building are in the Cleveland Terminal Group and are, in fact, under the same roof. The zone number, therefore, remains the same—Cleveland 15.

The move was necessary to provide more adequate working quarters for the firm's enlarged Cleveland staff.

UNIT

NEW FULL VISION CAB

mobile CRANE

SELF-PROPELLED

5 to 7 TON

Write for particulars

Powerful, fast-stepping Mobile Crane... one-man operated... for "on and off" highway operations... simple to operate... (eliminates cut-up terrain, mutilated concrete docks and runways.)

UNIT CRANE & SHOVEL CORP. MILWAUKEE 14 WISCONSIN

DROP-FORGINGS

ANY SHAPE • ANY MATERIAL • COMPLETE FACILITIES

Write for Free Forging Data Folder... Helpful, Informative

J. H. WILLIAMS & CO., "The Drop-Forging People" BUFFALO 7, N. Y.

Incentive Pay Plan Proposed by Ford Motor Co.

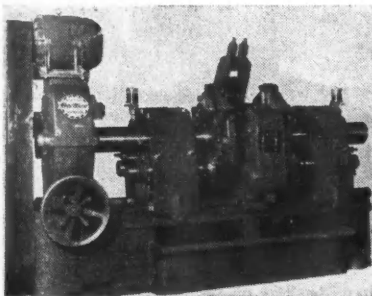
An incentive pay plan for steel mill workers has been proposed by the Ford Motor Company. The purpose in suggesting the plan is to step up Ford's steel production. Company officials said that unless more production can be achieved, it may be impossible to operate the steel mill after the war. This is the first time in the history of the Ford company that such a plan has been considered.

The company is preparing to have every job in the mills restudied for time consumption. It is anticipated that the necessary negotiations will take several months, with the possibility that the plan, if it finally is agreed upon, will go into effect this summer.

The percentage of the pay rate to be considered the base, and the percentage which will be incentive pay for maintaining a normal production, will be determined in negotiations. Increased tonnage over normal production also will be rewarded by a pay override for the workers. Any plan worked out in negotiations will be subject to approval by the War Labor Board, and will affect approximately 3,000 Ford workers. Seventy-five per cent of the steel mill's war output goes to other consumers.

New Production Equipment

(Continued from page 36)

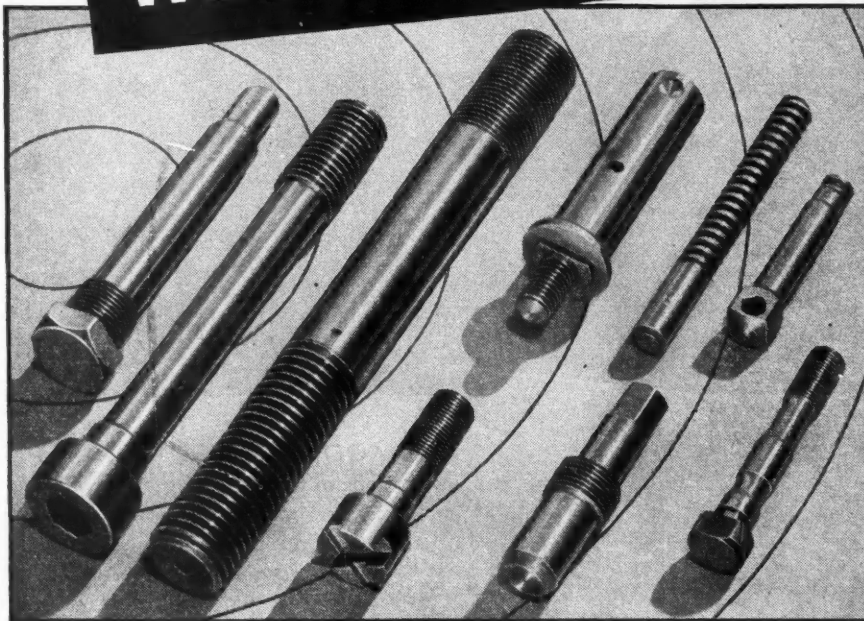


No. 1-A Roto-Matic milling machine

station and held by a spring arrangement until the toggle chain clamping device provides positive holding action during the milling operation. This positive holding action is released after the milling operation has been completed.

THE Lima Electric Motor Company, Lima, Ohio, has made a new addition to their selective four-speed machine tool gearshift drive line. This unit is designed to power machine tools and other equipment requiring motor capacities of 1 hp or less. The unit is rated at $\frac{1}{2}$ and $\frac{3}{4}$ hp at 1200 rpm and 1 hp at 1800 rpm.

YOU DESIGN 'EM WE'LL MAKE 'EM



Versatile, exacting, efficient—yes, we admit that we are all of these and more . . . In developing a source of supply for screw machine products, you can counsel in confidence with The Chicago Screw Company.

For almost three-quarters of a century we have excelled in producing precision-made screw machine products. The "Know How" accumulated over these long years of experience has resulted in an organization that is exceptionally well qualified to help you with your present

problems and post-war developments . . . If your requirements run into hundreds or millions of pieces, regardless of size, shape or material — you design 'em, we'll make 'em.

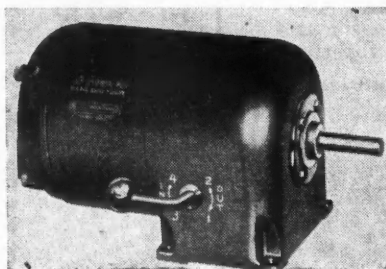


THE CHICAGO SCREW CO.

ESTABLISHED 1872

1026 SO. HOMAN AVENUE CHICAGO 24, ILL.

The new unit, identified as Type R, is designed for continuous operation. A
(Turn to page 86, please)

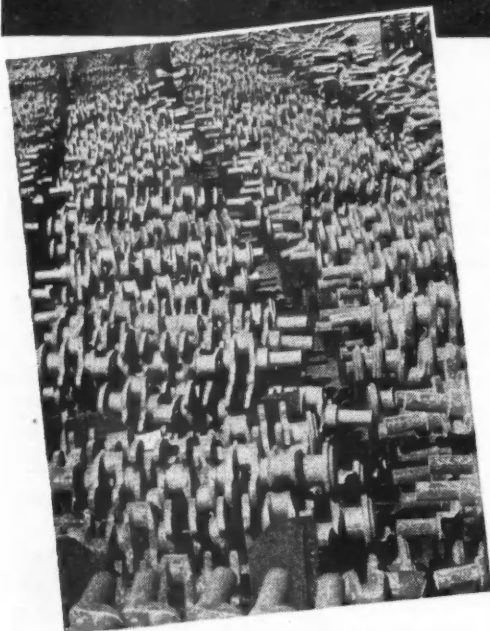
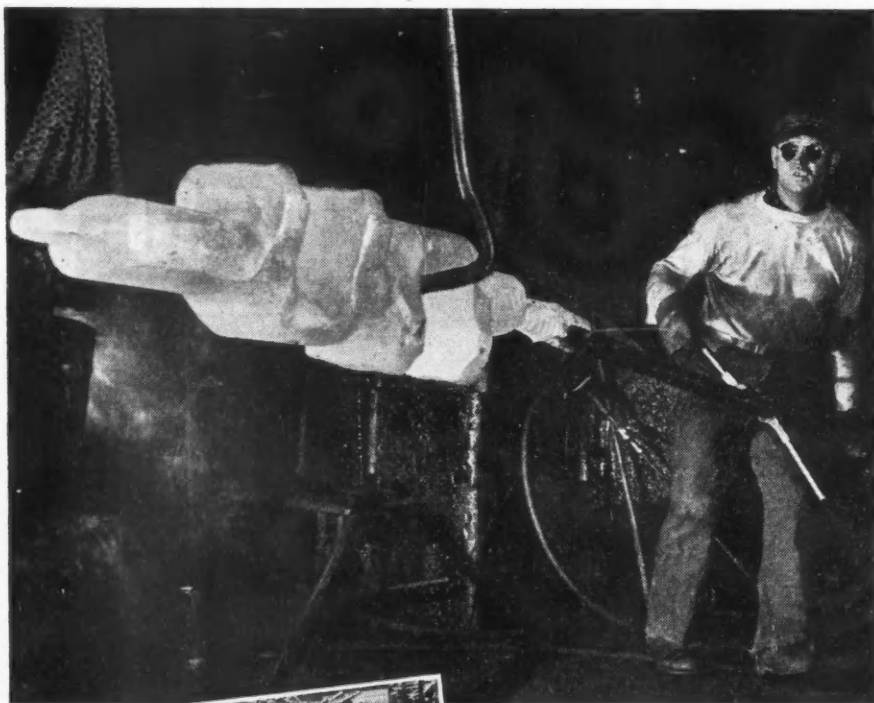


Selective 4-speed gearshift drive
made by Lima Electric Motor Co.

Trucks for Civilians In Atlanta Area

Several hundred trucks a month for civilian use now are rolling off the assembly line along with military trucks at the Atlanta, Ga., plant of the Chevrolet Div. of General Motors Corp. Formerly the plant had been producing military trucks only.

Trucks produced at the plant are being distributed for civilian use in the Atlanta area. Monthly production schedules are being set up in accordance with military and civilian truck allocations agreed upon by OPA and military procurement officers.



CONTROLLED QUALITY
from the time of the arrival of raw material at Wyman-Gordon plants until the finished forging is delivered . . . every step constantly under scientific laboratory control . . . and behind every Wyman-Gordon forging stands the broadest and longest experience in the industry.

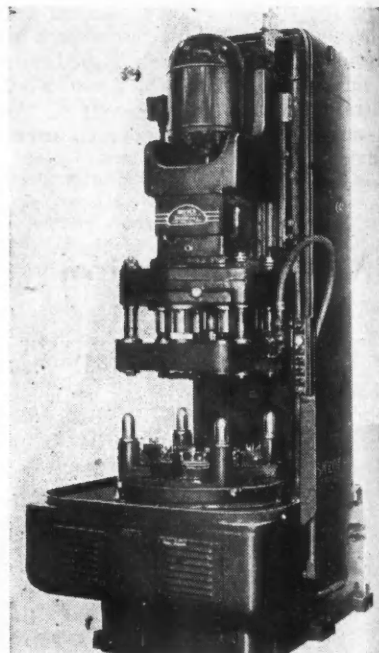
WYMAN-GORDON has the "know-how," the equipment, and the organization to make quality forgings, all the way from five to five hundred pounds.

WYMAN-GORDON
WORCESTER • MASSACHUSETTS
HARVEY, ILLINOIS DETROIT, MICHIGAN

Lima semi-enclosed, drip-proof, ball bearing motor of either two or three phase, 50 or 60 cycle, 220, 440 or 550 volts is furnished as a standard integral part of this unit. Type R is reversible in all speeds with the use of a reversing drum control. Single phase units in above sizes to be available when conditions permit.

A SNYDER Standard 10 V 18 drilling machine designed and built by Snyder Tool & Engineering Company, Detroit, Mich., equipped with a five-spindle head and using four indexes to complete its hollow milling job on 20 bosses, provides an example of how this standard machine can be equipped to perform special operations far beyond the scope of the conventional standard machine.

The index table housing serves as a chip trough and coolant retainer. The standard index mechanism provides the smooth accelerations and deceleration
(Turn to page 88, please)



Snyder 10 x 18 drilling machine

FELT

We make FELT to close standards for thousands of uses. War demands and technological advances are regularly developing new applications. We can help you.

American Felt Company

General Offices:  GLENVILLE, CONN.

New York Boston Chicago Detroit Philadelphia St. Louis
Cleveland Los Angeles San Francisco Dallas Seattle

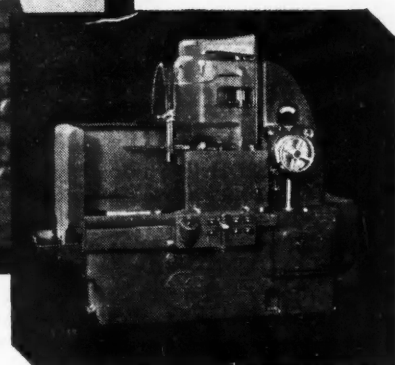
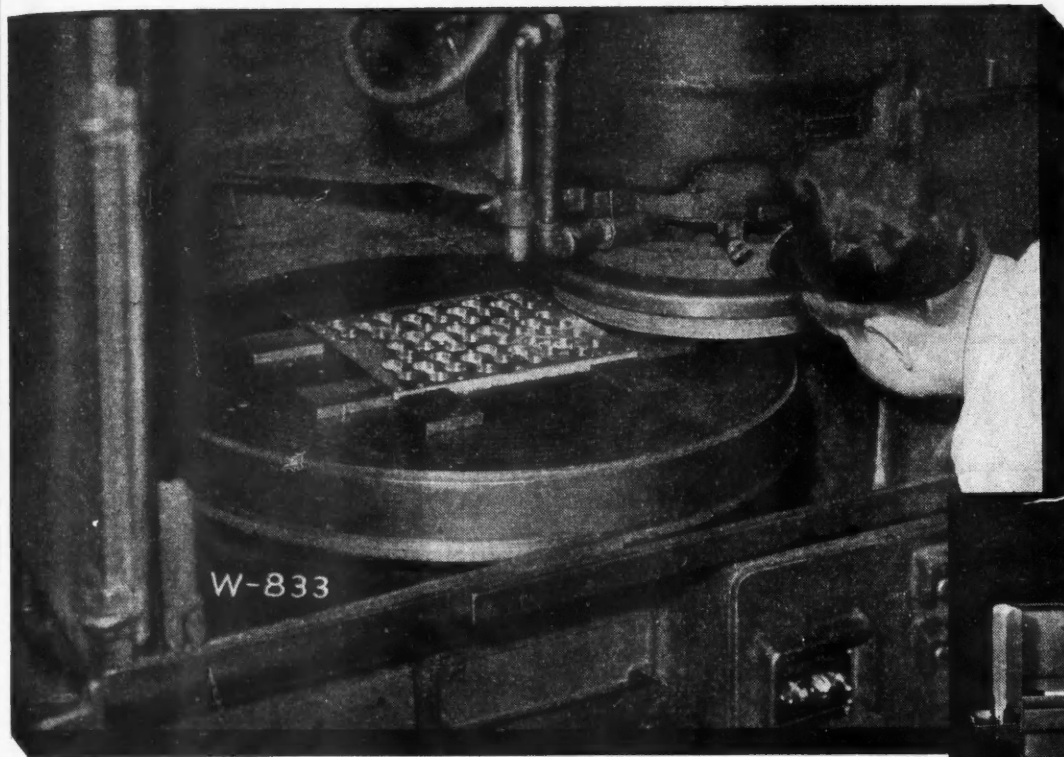


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LONG ISLAND CITY... 47-28 37th St.
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MEDIUM PRESSURE HIGH DEFLECTION
HIGH PRESSURE MEDIUM DEFLECTION

"Put it on the Blanchard"



No. 18 BLANCHARD SURFACE GRINDER

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The brass plate is laid on the magnetic chuck and blocked on all sides by steel pieces held magnetically. The picture shows the plate as chucked for finish grinding. In rough grinding the same setup is used with shims under the work, if needed, to prevent rocking.



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March 1, 1945

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87

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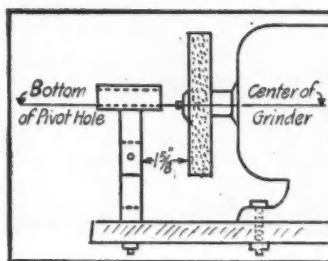
Attached to the Drill Sharpener, it adjusts drill edges to the proper angle for precision grinding, putting drill sharpening on a quick, efficient basis.

QUICK-SET DIAL easily and accurately adjusts Sharpener for sharpening drill from $5/32"$ to $1"$ sizes. Dial insures accuracy in measuring angles and clearances on twist drills, preventing trouble and making drills last longer. Dial-Set sharpened drills cut faster and more accurately, as the edges are alike and uniformly sharpened.

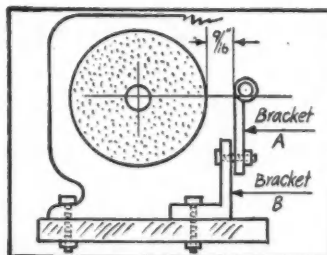
Precision built, calibrated and tested, unit is easy to set up and operate. Saves wear and tear on drill presses—prolongs drill life—cuts costs—improves quality—speeds output.

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Front view of grinder



Side view of grinder

of the Geneva wheel, hydraulically powered from the hydraulic system of the machine itself.

Basically, this is a general utility machine, yet, it can be adapted to do many jobs with "special machine" efficiency through the use of special fixtures, heads and tools.

LEMPCO PRODUCTS, INC., Bedford, Ohio, offers the Lempco Model ACX internal and surface grinder which turns and grinds internal, external, face and taper jobs. A micrometer screw adjustment on the automatic power cross feed assures precision face grinds. Both rack-and-pinion and screw feed



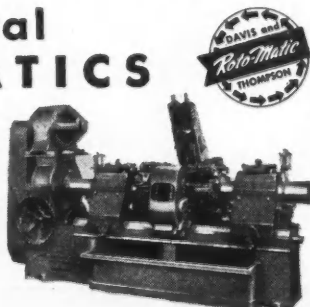
Lempco model ACX internal and surface grinder

are available for longitudinal travel. The grinding head spindle, with speeds of 6000 and 12,000 rpm., is driven by a 2-hp. motor. Jaw or magnetic chucks are mounted on the face plate by a single draw bar through the hollow work spindle. A $1/2$ -hp. motor drives the quick-change work spindle at 80 or 130 rpm.

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Brockhouse Torque Converter

(Continued from page 35)

of this and other elements is of vital importance to the efficiency of the transmitter. The casing is completely filled with oil, which, when the engine is running, is thrown tangentially from the pump vanes and impinges upon the blades formed on the periphery of the turbine first-stage rotor. The kinetic energy thus transferred tends to turn the rotor in the same direction as the engine.

But when the fluid has passed through the vanes of the first-stage rotor it still has considerable velocity; so, to extract all its available energy, the fluid is directed on to vanes carried within a shrouding ring of the reaction member. At this point the fluid moves in a direction contrary to that of the first-stage rotor and the function of the reaction member is to turn it back to its original direction before it impinges upon the vanes of the second-stage rotor. From the latter the fluid passes back to the pump element through ducts in the center of the assembly and is recirculated.

In order to change the direction of the fluid between the two turbine stages, the reaction member must be rigidly held against rotation in the reverse direction to that of the pump and turbine during torque conversion. On the other hand, when conditions that should establish a 1 to 1 ratio between pump and turbine, the direction-changing (reaction) member must be free to revolve with the other members. This requirement is met by mounting the reaction member on an automatic uni-directional clutch—a "free wheel"—which at 1 to 1 ratio conditions (when the ratio of fluid circulation is low) allows the fluid to carry the reaction member rotating with it.

As and when the torque loading on the turbine increases, the fluid circulation turbine rotor speed ratio increases and the reaction member becomes subject to pressure that would drive it in contra-rotation; but the free wheel

(Turn to page 92, please)

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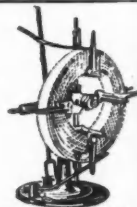
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Personal examination will reveal to you many additional economy features incorporated in this modern screw. Ask us to mail you a package assortment of CLUTCH HEAD Screws and sample Type "A" Bit with fully illustrated Brochure.

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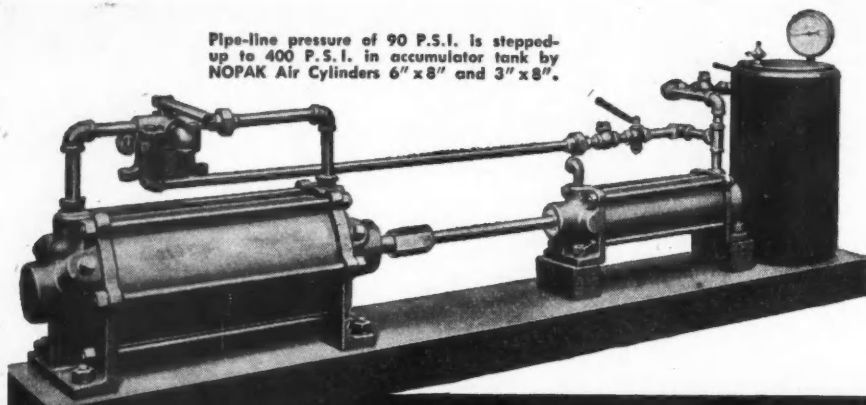


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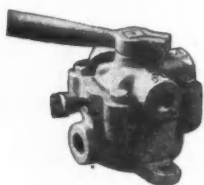


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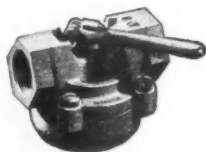
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comes immediately into operation and holds the reaction member stationary.

In commenting upon the design details of this device, Professor Lea has pointed out that, in the past, the major causes of loss of energy in devices of this type have been (1) unsteadiness of motion of the liquid medium within the ducts constituting the hydraulic circuit and (2) shock at the inlet of the driven element. The first, although less important, is fundamental; the second, of considerably greater importance, is a result of the first.

Pursuing this point, Professor Lea points out that as the liquid has to pass from a vaned driving element to a similar driven element rotating at, perhaps, a greatly differing and constantly varying speed, it is important—if losses of prohibitive magnitude are to be avoided—that the rotational velocity with which the liquid emerges from the driving element should be so controlled that the direction in which it impinges upon the receiving ends of the vanes of the driven element is constantly maintained without appreciable shock. Therein lies the fundamental characteristic of the Brockhouse unit, for the centrifugal pump forming the driving element is so designed and constructed that the motion of the liquid in its ducts remains steady for the velocities that obtain in them. Thus both the fundamental and consequential causes of loss of energy are virtually eliminated.

It has been held that, to enable such a transmitter to perform effectively the functions of a clutch, the driven element must have vanes with characteristics widely different from those required for the performance of the functions of a variable gear, which would indicate the need for mechanically variable or deformable vanes. In the Brockhouse device, however, any such complication is avoided, the profile of the vanes being such that their hydraulic action, in co-operation with that of the reaction member, varies with altering conditions, despite the fact that neither their disposition nor their conformation is variable. Reaction vanes have been evolved of such a shape that,

(Turn to page 94, please)

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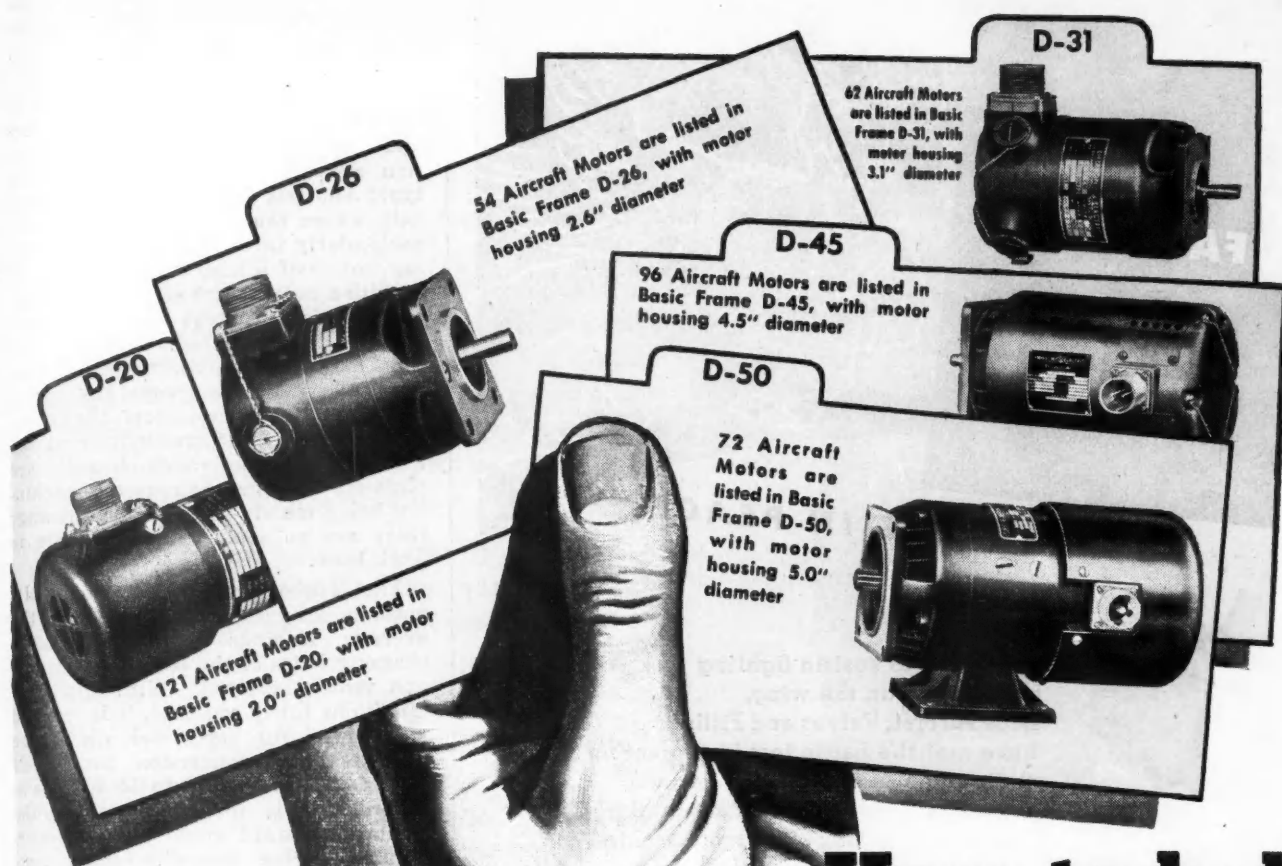
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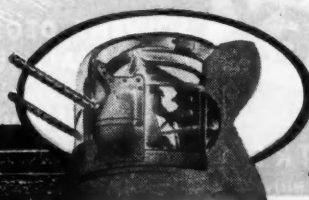
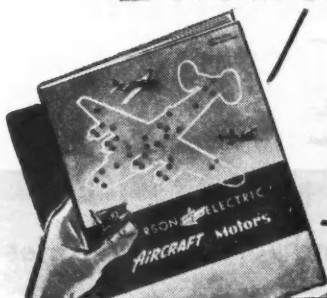
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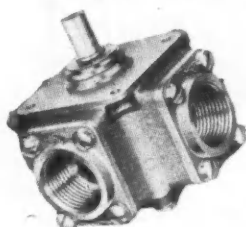
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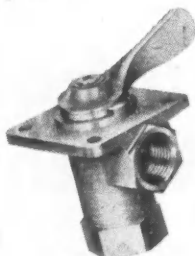
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when their action is not needed, the effect of their angular disposition becomes neutralized for all practical purposes.

Here it may be mentioned that in the Turbo Transmitter as made for cars and light trucks the driven and reaction elements are of the single-stage type; but this construction is suitable only where the power-weight ratio is particularly favorable. Where a starting torque of a high order is required, as with a heavy truck or bus, the driven and reaction members are of the two-stage type as described. Another point that may here be mentioned is that when the vehicle overruns the engine there is no free wheel effect, the engine being drive by the transmitter at the 1 to 1 ratio. The vanned elements are plain die castings, the required machining being mainly drilling and turning; there are no smaller inserts liable to work loose.

The Turbo Transmitter, obviously, must be designed with reference to the average loadings and performance characteristics of the particular engine and vehicle involved. With operating conditions fairly constant, it is claimed to be ideal for buses, for which the normal torque conversion range has been found in service to be adequate. Where this is inadequate a supplementary forward speed can be incorporated in the propeller shaft line, thereby multiplying the conversion range by the step provided by the auxiliary gearing. This has been done in the case of two trucks. One of these, carrying a load of 8½ long tons, has been provided with a 2.15 to 1 auxiliary mechanical gear, which enables the loaded vehicle to start easily on a gradient of 25 per cent. The other truck similarly equipped has an auxiliary gear of 1.7 to 1 and with this the transmitter has been able to produce a drawbar pull of 6000 lb from a standing start.

The progression of acceleration, naturally, is so smooth as to be deceptive; it does not appear to be nearly so rapid as it actually is. Tests on Brooklands Track of the 27-hp Humber car showed that with the transmitter a speed of 50 mph was reached from a standing start

(Turn to page 96, please)



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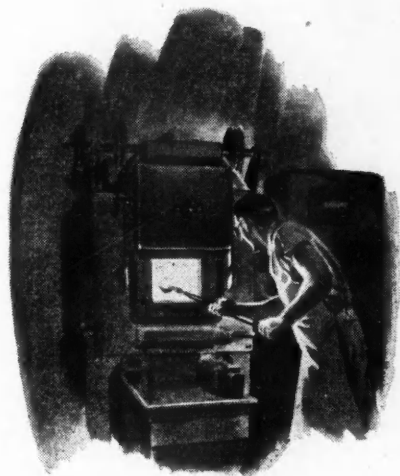
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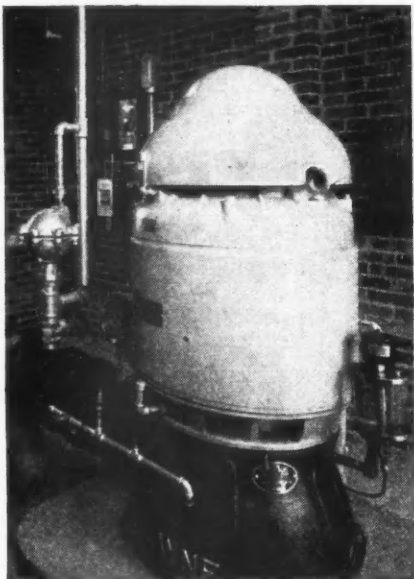
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in 10.6 seconds by holding the car on the brake while the engine was accelerated to the speed of highest torque and then releasing the brake. With the same car and an ordinary gearbox the corresponding time was 10.4 seconds.

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(Turn to page 98, please)

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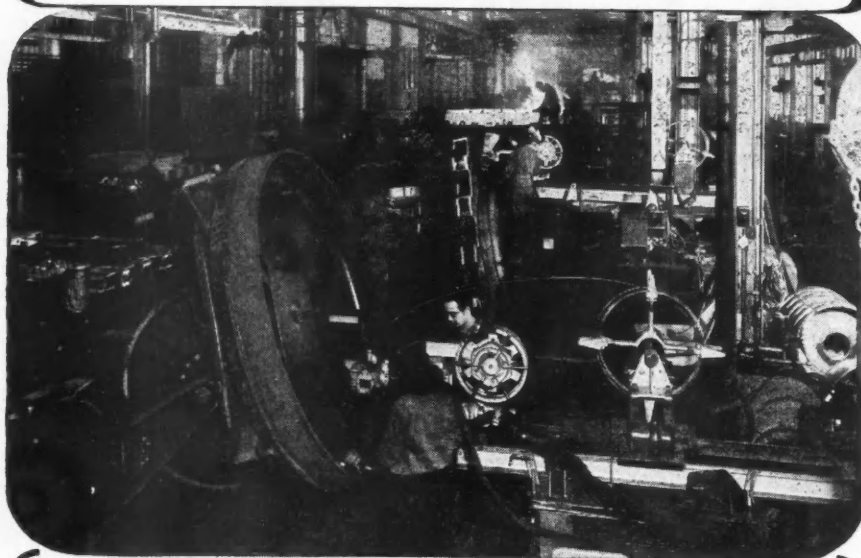
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C-F POSITIONERS



Production Welding will be automatic—on C-F Positioners

Wartime advancement in automatic welding makes certain its wide use as a standard production method in postwar manufacturing. As now, much of it will be done on C-F Positioners, because: (1st) They permit a down hand weld on all sides with but one set-up—rotate 360°, tilt to 135° beyond horizontal under push button control. (2nd) The exclusive C-F variable-speed drive which will give table rotational speeds from 0 r.p.m. up. (3rd) C-F Positioners come in sizes and capacities for every weldment—are universal tools equally efficient for job work or the production line.

Write for Bulletin WP-22

CULLEN - FRIESTEDT CO., 1322 S. Kilbourn Avenue, Chicago 23, Ill.

mitter suits the engine speed to the load at any moment, the most effective torque ratio being established automatically by the normal operation of the device. It is admitted that at any particular ratio, fuel consumption may be somewhat inferior to that of a purely mechanical drive. The fuel consumption may be of the order of 5 per cent higher but as compensation there is no clutch maintenance, no shock loadings on propeller shaft and driving axle and no harsh stressing of the tires, while in the mechanism itself, including the planetary gear provided for reversing, there is a minimum of parts requiring attention in maintenance.

A characteristic of the system that may be mentioned in conclusion is that when it is giving a high torque the engine speed can never rise above a predetermined maximum—usually about 2000 rpm—making it impossible for a driver to race his engine on the lower "gears," as can happen with a mechanical transmission.

British Tax

(Continued from page 64)

tax; it will not, for instance, place a premium on the small bore, long stroke engine. But it will encourage designers to "beat the tax" by using small high-speed engines in small chassis with the passenger accommodation restricted in order to secure a reasonable standard of performance.

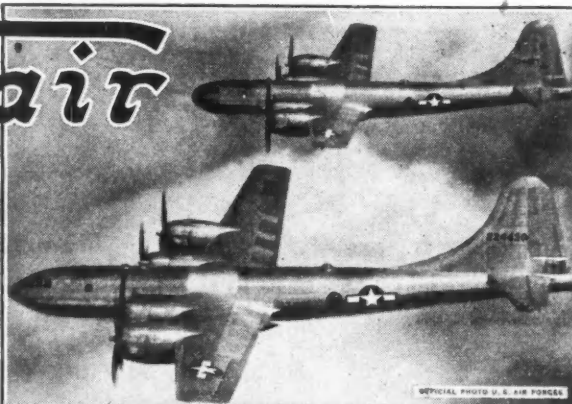
Morris Cars in India

As a result of negotiations between the firm of Birla Brothers, of Calcutta, and the Nuffield Organization in England (manufacturers of Morris, Wolseley, Riley and M.G. cars and Morris Commercial trucks) a company has been formed for the manufacture of Morris cars in India. The title of the new company is Hindustan Motors Limited.

Initially, the company will concentrate on the production of one model only, the 10-hp Morris saloon, a four-door, four passenger type. In the early stages the cars will consist almost exclusively of parts supplied by the Nuffield Organization from England and assembled in India by Indian labor under the guidance of Nuffield engineers. But as and when local labor becomes more experienced and local facilities enable components to be manufactured from British patterns, the cars will become progressively "Indianised."

Tel-air

"MEANS
ACCURACY"



TEL-AIR PARTS COUNT IN THE
ACHIEVEMENT OF VICTORY...



Another Tel-Air Part. Small segment showing three operations—blanking, cutting the teeth, and forming. Note comparative size.

Even such tiny segment gears as the one illustrated here must be unfailingly accurate in operation if some

essential war machine is not to falter in its mission of destroying the enemy. Tel-air accuracy means absolutely uniform precision, tolerance and concentricity in every machining and finishing operation. It is this kind of precision engineering and workmanship which we are putting into intricate bomb fuses and hundreds of vital component parts for the war effort.

Now! We Are Not Interested in our Post-War Products.
We Are Only Interested in Winning the War.

In the Air it's
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On the
Highway it's
Teleoptic

Every Day There Is a
Chance to Do Something
for Our Fighting Men.
Let's Do It